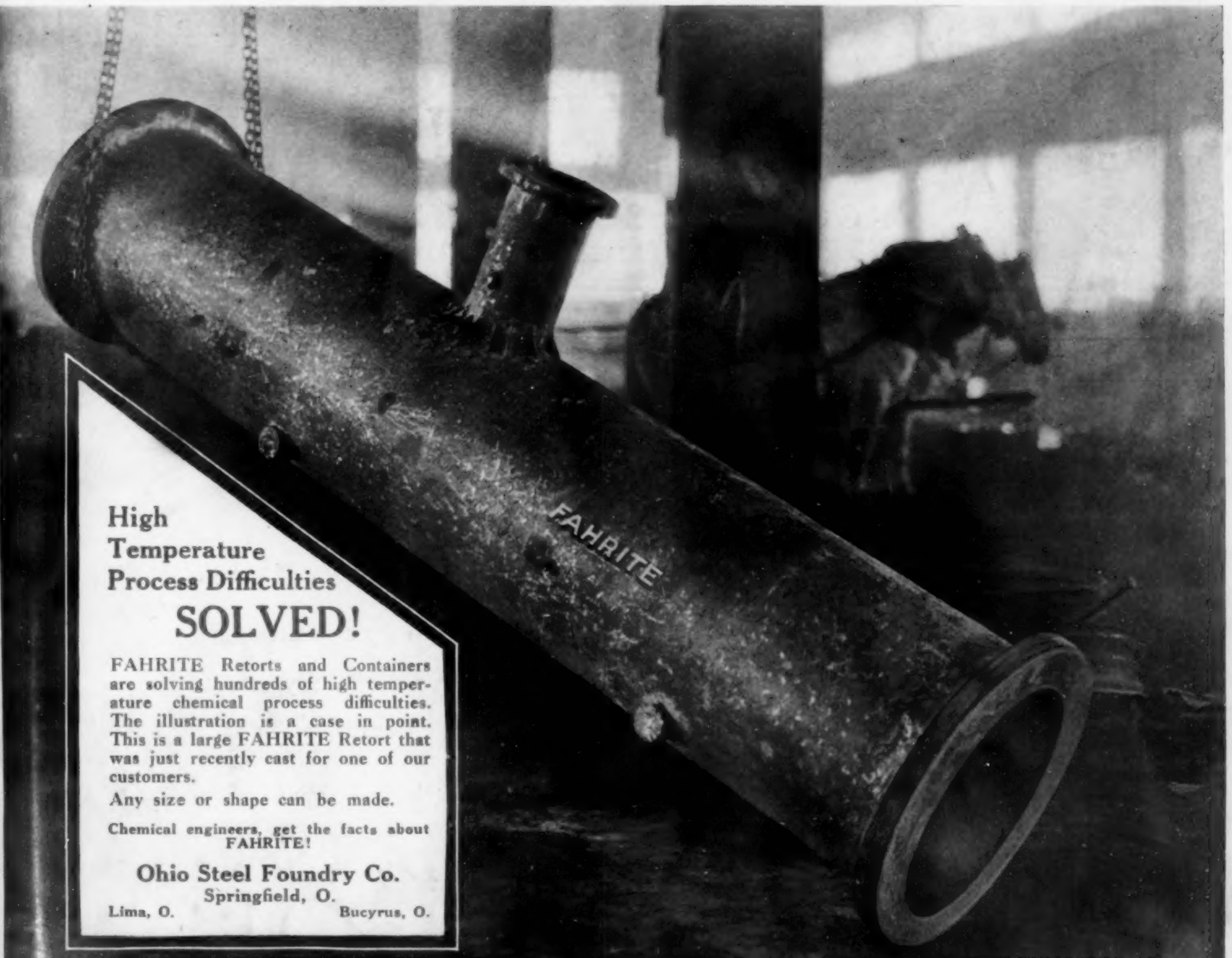
CHEMICAL LIBRARY
JAN 29 1924

CHEMICAL & METALLURGICAL ENGINEERING

McGraw-Hill Co. Inc.

January 28, 1924

25 cents per copy



High Temperature Process Difficulties

SOLVED!

FAHRITE Retorts and Containers are solving hundreds of high temperature chemical process difficulties. The illustration is a case in point. This is a large FAHRITE Retort that was just recently cast for one of our customers.

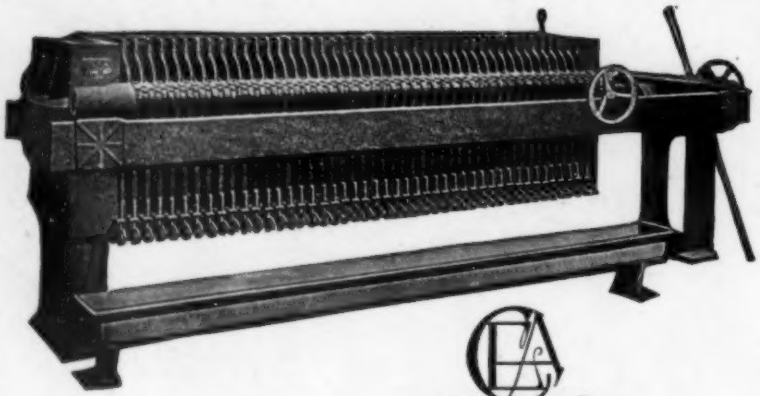
Any size or shape can be made.

Chemical engineers, get the facts about FAHRITE!

Ohio Steel Foundry Co.
Springfield, O.
Lima, O. Bucyrus, O.

FAHRITE CASTINGS

For High Temperature Chemical Processes



Why You Should Use Shriver Filter Presses

The many exclusive features incorporated in the make-up of Shriver Filter Presses save time, labor and money. These advantages should make them the logical filter presses to use in your factory.

Simple in construction, skillfully designed and always reliable, Shriver Presses once used are always used. Send for catalogue, illustrating and describing the many exclusive advantages of Shriver Presses.

T. SHRIVER & CO.

808 Hamilton St., Harrison, N. J.

The filter cloth used is just as important as the filter press. We are in a position to supply filter paper or filter cloth especially woven for fil.er press work, at very close prices. Ask us to quote on your filter cloth requirements.

BETTER TO SERVE INDUSTRY

Proctor

DRYING MACHINERY

PROCTOR & SCHWARTZ, INC.

PHILADELPHIA

Barnstead Water Stills

Economical in first cost and in conservation of heat. Preheating arrangement supplies c. p. water, free from ammonia and other gases.

Depth of boiler prevents frothing over of impurities. Stopcock at side permits of easy cleaning.

Arranged for heating by gas, electricity, steam or kerosene. Sizes from one pint per hour up.

WRITE FOR BULLETIN 295.

EIMER & AMEND

Established 1851

Headquarters for Laboratory Apparatus and Chemical Reagents

200 East 19th Street, New York, N. Y.

Washington, D. C.—Display Room
Evening Star Bldg.

EIMER & AMEND NEW YORK

Pittsburgh, Pa.—Branch Office
8085 Jenkins Arcade

CHEMICAL & METALLURGICAL ENGINEERING

A consolidation of
ELECTROCHEMICAL & METALLURGICAL INDUSTRY *and* IRON & STEEL MAGAZINE

H. C. PARMELEE, Editor

Volume 30 | New York, January 28, 1924 | Number 4

The Value of Superfluous Work

IN THE recent award of the Perkin medal to Frederick M. Becket, a personal incident was brought to light that probably would escape the prosaic chronicler of the day's news; and yet it contained the essence of success, not only in Becket's case but in that of many another leader.

When he was notified by the committee that he had been chosen as one who had done valuable work in applied chemistry and that his achievements were to be recognized by the award of the Perkin medal, his first thought was that he must now work harder than ever in order to maintain the high standard of Perkin medalists. Then, wondering why this honor had come to him who had not dreamed of receiving it, he took from his pocket a worn clipping, on which was this paragraph by Cushman K. Davis:

> "The men who have achieved are the men who have worked, read, thought more than was absolutely necessary, who have not been content with knowledge sufficient for the present need, but who have sought additional knowledge and stored it away for the emergency reserve. It is the superfluous labor that equips a man for everything that counts in life."

This led to some introspection from which Mr. Becket drew the conclusion that "superfluous labor" was the only reason for awarding the medal to him. We relate the incident not to show the advantage of carrying inspiring sentiments in the pocketbook; they must be translated into action as a result of deep conviction. Thus again our attention is directed to the fact that hard work, futile and superfluous though it may sometimes seem, makes a weak man strong and, as in the case at hand, a strong man great.

Competing for Muscle Shoals

SHORTLY after Mr. Ford made his original offer for Muscle Shoals on July 8, 1921, there was an insistent demand that the manufacturer's proposal be accepted; and that insistence has been repeated at intervals up to the present time, supported by well-organized propaganda and the magic of Henry Ford's name. We opposed hasty action because we believed that the time was not ripe for the sale of the power project and nitrate plants to the best advantage of the government. In our issue for Sept. 21, 1921, we said editorially:

> "It is not necessary to accept Mr. Ford's offer because it is the only one made at this time. Other companies in the chemical manufacturing business would doubtless pay considerably more for the property listed above were it not for the present financial depression. They simply cannot in sound business policy entertain expansion when their own plants are running at low capacity. In the meantime the government can afford to wait, for cash maintenance in standby condition costs only the time of a few officers, a score of men and a negligible amount of material. . . . The government can afford to wait for a better market."

Subsequent events have confirmed our opinion. Congress now has for consideration Mr. Ford's original offer, a proposed modification to bring it within the scope of the federal water-power act, a bid by nine associated power companies of the South, another by the Union Carbide & Carbon Corporation and finally one not yet released by Secretary Weeks, supposed to be made by E. H. Hooker and associates. On superficial examination it would appear that any of the others is better than the first.

In spite of this array of substantial offers by reliable companies of long experience in the power and chemical industries, it is reported from Washington that "the sentiment on the committee in favor of the Ford offer is so strong that it . . . is not unlikely that the committee will report favorably upon the Ford offer without taking advantage of the unusual opportunity to make a better deal with the interests that have submitted offers." The whole matter is still in a nebulous state and we are loath to believe that Congress will not consider the various offers on their merits, approaching the problem as business representatives of the people. We have no animosity toward Mr. Ford nor any brief for his competitors. But we insist that the disposal of the power and chemical plants at Muscle Shoals shall be free of the taint of political favoritism and in the best interests of the government.

Passing of The Tank House

ALTHOUGH there is much truth in the familiar statement that the modern packing house utilizes even the pig's squeal, no one who has been in or even near one of these plants will deny that the methods that produce this efficiency leave much to be desired from the esthetic point of view. So adaptable to environment is the human system, however, that in some of the larger centers of the industry residents of districts near the yards will dispute the existence of odors which to the newcomer are almost unbearable. In other localities, where packing houses and rendering plants furnish employment for only a small percentage of the population, these establishments have long been considered public nuisances, subject to strict regulation as to location and method of operation.

Now the seat of most of the obnoxious odors is the tank house. Here various materials containing fat are placed with water in large closed tanks and cooked under pressure with live steam. According to the nature of the materials charged, the fats drawn off may be: Prime steam lard; edible or inedible tallow; white, yellow or brown grease. The water layer remaining in the tank is separated by draining and hydraulic pressing into two parts: A solid portion, which is dried in rotary driers to form digester hog

tankage or fertilizer tankage; and a liquid which after concentration in multiple effect evaporators is added to the fertilizer tankage just as it enters the driers. It is thus evident that the tank house is a most important division of the byproduct department.

Since the presence of water in the cooking tank seems to be responsible for the decomposition that causes the vile odors, numerous attempts have been made to render these materials in the dry state, but it is only within the past year that the process of dry rendering has been widely adopted on a large scale. In this new method, steam-jacketed fat melters replace the tanks. After cooking, the charge is removed to a draining box having a perforated bottom through which most of the separated fat flows to storage. Anderson expellers reduce the fat content of the residue to about 6 or 7 per cent, discharging a dry cake which forms cracklings, an excellent feeding material worth substantially more than wet method tankage. At no point in the process is there any disagreeable odor, even the cracklings being sweet and not at all unpleasant to the sense of smell.

The new process is thus characterized by an unusual variety of advantages. In some localities the factor of odor elimination may give new lease of life to packing houses that were on the verge of being closed out as public nuisances. Raising the grade of the final residue from a fertilizer to a feedstuff materially shortens the nitrogen cycle and is thus of tremendous economic significance. But even more important from the producers' standpoint are the savings in capital investment, reduction in operating time and increased value of products. With the possible exception of certain plants where unusual conditions obtain, the tank house is doomed. Many of the larger packers already have begun to substitute dry rendering on a large scale and this change marks one of the most important developments ever made in byproduct technology.

Safety Engineering Through The Use of Conveyors

THE use of automatic material-handling equipment has been frequently urged in *Chem. & Met.* as a means of reducing the cost of production, of increasing plant efficiency and of filling the ever-increasing gap in the supply of common labor. But the viewpoint on such machinery put forth at the recent joint meeting of the American Society of Safety Engineers and the engineering division of the National Safety Council was from a decidedly new angle.

For instance, a conveyor used for loading 5-gal. cans of petroleum into the hold of a ship allowed a reduction of 96 per cent in labor employed for handling. Looking at this figure from the safety engineer's point of view, the probability of accident is also reduced 96 per cent. This is obvious, of course, if one stops to think of it, for four men engaged in handling cans of oil will—other things being equal—experience only 4 per cent of the accidents that would occur in the natural course of events to 100 men.

This seems to add one more unescapable argument to the several already advanced in favor of material handling by machinery. For one thing, a lessening in the number of employees lessens the cost of liability insurance. Beyond this, each accident in a plant and the consequent substitution of one man for another costs something; and a reduction in the number of accidents diminishes this item of expense. Finally, though the hard-boiled in business might not admit it, human happiness and welfare are great factors in successful industry and nothing contributes to this end so much as the prevention of industrial accidents.

Cincinnati Is Over the Top

THE campaign for funds to insure prompt publication of the International Critical Tables of Physical and Chemical Constants has been under way for several years. But only lately has the real influence of the advisory organization, built up throughout the country, begun to be felt. The local committees are only beginning to find themselves in this work and report real progress.

The Cincinnati committee reports that its quota has been raised and that even more is likely to follow. This is the first local committee to reach the goal set for it, and Cincinnati has our cordial congratulations on its achievement. The work of other committees should now be pushed forward to completion so that the trustees of the Tables and the National Research Council can see their way clear to publication on a basis that will make the Tables available to the largest possible number at the lowest price consistent with the magnitude of the job and the value of the product. The reputations of American science and industry are at stake in this international project.

Is Technical Education Necessary for Executives?

IS A college or university training essential in the equipment of a first-class business executive? The view of the National Industrial Conference Board that 150,000 more executives will be needed in 1930 lends point to the question. It also brings up other questions, whether the universities and technical schools are turning out men properly equipped to fill these executive positions, and whether the boy who enters business from high school does not stand at least as good a chance to succeed as the university trained man.

The *Brooklyn Daily Eagle* has recently conducted a questionnaire of leading business executives of the country on these questions. All practically agree that university training for executives is beneficial—provided the recipient has the right stuff in him to begin with and provided he does not get what is popularly called "swelled head."

On the latter point Charles M. Schwab, chairman of the board of directors of the Bethlehem Steel Co., says that many of our college boys "go into a great industrial establishment and imagine that because they have a diploma from some college or university they are on a plane different from other men. Unless this idea is quickly removed from their heads, they do not get very far in business." However, he believes that once this lesson is learned the college-trained man is better equipped to grapple with the problems of life than one not college trained.

Somewhat the same idea is expressed by A. C. Bedford, chairman of the board of directors of the Standard Oil Company of New Jersey. He says: "With equal natural characteristics, graduates of engineering schools and universities should be able to advance more rapidly, but they must all start at or near the bottom in com-

petition with men of less schooling, not only to maintain the morale and team spirit that come only with a policy and practice of promotion from within the ranks, but because, according to my experience and observation, there are fully as many, if not more, leaders developed from that group of young men who have not had formal education than from those who have."

Many who replied to the questionnaire would have closer co-operation between the colleges and industry. "No college can supply horse sense," declares Samuel M. Vauclain, president of the Baldwin Locomotive Works. Philip T. Dodge, president of the International Paper Co., says: "In many fields 4 years of constant association with active and experienced men will develop the necessary qualifications and the special knowledge which must be acquired to better advantage than the same time spent in a university."

The *Eagle* comes to the conclusion, after analysis of the thirty-five replies, that: "A college education does not assure, and is not essential to, success as a first-class business executive, but the man otherwise endowed with the qualities of leadership is likely to be made a better and more successful business executive by college training."

Avoiding Detours Along The Chemical Highway

NOT so many years ago a great corporation was organized for the purpose of exploiting a new and highly complex chemical process. In the make-up of the organization were outstanding financial geniuses, the sharpest of legal brains and the shrewdest of business ability. Lacking, however, was any appreciation of fundamental, systematic research: the technical staff was regarded as a conventional but rather useless appendage. For a time the corporation prospered, for the output of its plant seemed but to whet the appetite of an almost insatiable demand. Then something happened. The process became involved in difficulties which no one was able to understand or overcome. Expensive consultants were called in and in order to pay them the management economized by dismissing what little research staff it had. Finally the plant was thrown overboard as a failure and the management turned back to Wall Street to finance a new venture and a new plant that no one knew how to run.

The corporation tried to take a short cut to success and instead it struck a detour. Only two guides are available to get it back on the main road. One is brute luck, which it has preferred to follow so far; the other is systematic research, a good guide, but one that must be called before the victim is hopelessly lost.

Now, for a second time, the corporation is making its start along the chemical highway to success. It will be interesting to watch the progress of its travel.

Results of Mismanagement

AS A natural consequence of its unfriendly attitude toward research, the corporation to which we have just referred might well have been expected to hamper and misdirect its technical staff. Yet seldom has our experience revealed a more vicious example of the mismanagement of chemical engineering production.

This particular technical staff was, in the main, well chosen from men of a high order of ability. Constructive ideas were not lacking among them, although frequently these were ignored when reported by the staff only to be hailed by delight when brought in later from some expensive outside source. In fact, the offering of ideas was usually resented by the management as criticism and it became the custom of the technical men to confine their thoughts to themselves or to informal conversations with their colleagues. Practically every man on the staff was forced sooner or later into the attitude of preferring silence to this indifferent or openly hostile reception of his ideas.

Under such circumstances what is the reaction when the manager, contemplating some change or improvement, declines or neglects to consult his staff and instead calls in an outside consultant? The latter is naturally unwilling to admit that the members of the staff know more about the problem than he does, for has he not been called in to put them right? Accordingly he neither gets their ideas nor seeks their co-operation. The staff believes that, given the opportunity and a little encouragement, it could solve the plant's problems. When the outsider comes in, there is the temptation to say, "Well, if he thinks he knows more about it than we do, let him go to it!" Later, when mistakes come to light, as they frequently do under such circumstances, the consultant's ready alibi is, "Your technical staff was around when the work was being done, but no one said a word in the way of criticism or suggestion." The staff, also declining to accept the blame, retorts, "We were not consulted and were given the impression that if our ideas were wanted they would have been asked for."

Such is the impasse that results from the lack of co-operation. For the manager it indicates a sad lack of knowledge of human nature and a narrow conception of his position and obligation to industry. For the technical man it indicates a most unfortunate inability to make his services so valuable as to compel their recognition as an essential factor in successful chemical enterprise.

When Oil Is Cheap

AN OVERHEATED bearing in a starch conveyor caused the recent disastrous explosion in the plant of the Corn Products Refining Co., at Pekin, Ill. This, in turn, set fire to the box in which the conveyor ran, so that when a load of dry starch from the kiln house was dumped into the conveyor, forming a concentration of flammable dust and air, conditions were favorable for an explosion when the mixture reached the fire.

There are many things that can and should be done to prevent such occurrences in the future, and the work being carried out under David J. Price, engineer of the Bureau of Chemistry, Department of Agriculture promises constructive results in this direction. But there is one thing about this explosion which suggests that the management of plants where such accidents are likely to occur could do much to prevent them. Note where the fire causing the explosion started—from an overheated bearing. If plant maintenance and the inspection of operating equipment were properly carried out, explosions from causes of this kind could be averted. Proper lubrication would keep most bearings from overheating to the point where they start fires. And the oil to carry out this lubrication would be a cheap form of insurance.

A Recognition of Industry

In Selecting for Its President Dr. L. H. Baekeland, the American Chemical Society Honors Itself and the Industry It Represents

©*Underwood & Underwood*

Dr. Leo Hendrik Baekeland

THERE is significance in the choice of Dr. Leo Hendrik Baekeland for the presidency of the American Chemical Society. He brings to that organization not only the viewpoint of industry—the practical accomplishments of the man of business—but with this is combined the vision of the idealist. It is the rare quality of balance which he represents so well that is one of the reasons his selection is so significant in the society's history.

It is only natural that many if not most of the officers of our great scientific bodies should be recruited from the ranks of the university and college faculties. Men of industry are usually too occupied with business affairs. Society positions are greedy consumers of time and effort and the honor that attaches to them is more often academic than practical—that is, from the dollars-and-cents viewpoint of the ordinary industrialist. But that Dr. Baekeland is the exceptional industrialist has been demonstrated in many ways. A recent conversation will serve as a single example. Last October the distinguished inventor was approached by a representative of one of the Middle Western sections and asked, quite unofficially, if he would accept the tender of the presidency of the society. His reply came without hesitation. If the society really wanted him for its president, he would gladly serve, but with this reservation: To him the position meant work rather than honor and if elected he intended to give it every ounce of his effort and energy. Surely this is a happy augury for the American Chemical Society at a time when its serious problems of administration and procedure are the subject of critical study and investigation.

Dr. Baekeland's contributions to the progress of American science and invention are too well known to require repeating to even the youngest of *Chem. & Met.'s* readers. There is, however, in the story of his life a record of hard work and successful enterprise that cannot fail to stimulate all of us. He was born in Belgium in 1863 in the old Flemish city of Ghent. Here he received his early education in the elementary schools, in the Atheneum (a government high school) and in the Ghent Municipal Technical School. Entering the University of Ghent in 1880, he obtained his Bachelor's degree in 3 years, and a year later, at the age of 21, he became a Doctor of Science. Although the youngest graduate of the institution, his examinations were passed with highest honors.

The university still held its attraction for the young graduate, and he continued on the staff as assistant professor, later to be appointed associate professor of chemistry. About this time he took part in a competition among alumni that won for him a traveling scholarship in chemistry. This was to have a predominant influence in molding his later career. It not only enabled him to visit universities in England, Germany and Scotland, but, what was more important, it gave him the chance to make a coveted trip to the United States. Here he found that photography, his most intimate hobby at Ghent and the quest of many of his scientific studies, was in a budding stage of industrial development. He was so attracted to it that he decided to remain in this country and accepted a position as chemist with E. & H. T. Anthony & Co., manufacturers of photographic supplies. When this firm joined with the Scovill company to make "Ansco" films and bromide paper, Dr. Baekeland was retained as chemist in its factory.

Two years later he left this organization to take up a consulting practice and to devote himself to developing a number of chemical processes of his earlier invention. It was while in partnership with Leonard Jacobi in the Nepera Chemical Co. that Dr. Baekeland turned his efforts to perfecting the photo printing paper "Velox." In 1899, after the success of this product had been made apparent, the Eastman Kodak Co. offered to buy the entire business on very liberal terms. These were accepted, for they gave Dr. Baekeland the opportunity to take up new and attractive fields of research. Turning to electrochemistry, which was just then beginning its great industrial development in this country, he spent a year in study at the Technological Institute at Charlottenburg, near Berlin. On his return to this country one of his first tasks was to undertake the preliminary work involved in the industrial development of the electrolytic cell, which had just been invented by C. P. Townsend for the production of caustic soda and chlorine.

But the crowning achievement of Dr. Baekeland's technical career and the product for which he is best known in our industries is, of course, Bakelite—formed by the condensation of formaldehyde with phenol or its homologues. This has been the basis of a great new industry that has found its commercial development the world over. It has given us a new and better material of construction for which there are constantly opening new and broader fields of utility and service.

The Lower Limits of Concentration for

Explosion of Dusts in Air

In This Article the Authors Recount Some Recent Tests Made at the Bureau of Chemistry, Department of Agriculture, and Interpret the Results in the Light of Industrial Needs

BY L. J. TROSTEL AND H. W. FREVERT

Assistant Dust Explosion Engineer and Junior Development Engineer, respectively, Bureau of Chemistry, Department of Agriculture, Washington, D. C.

JUST as a knowledge of the lower limits of concentration for explosion of methane is used to insure safety in coal mines, information on the lower limits for explosion of dusts in air in industrial plants makes it possible to recognize dangerous conditions and serves as a guide in determining the ventilation and exhaust necessary to control such conditions. Recent studies of dust-measuring devices, with the final development of a satisfactory method to measure the quantity of explosive dusts suspended in air, make possible an effective application of the data thus obtained.

Powdered corn starch, corn elevator dust, wheat elevator dust, powdered sulphur, powdered sugar, powdered aluminum and Standard Pittsburgh coal dust were tested in the Bureau of Chemistry to determine their lower explosive limits in air from the standpoint of sensitivity to ignition as well as ability to propagate flame. The limits found agree very well, but they vary widely from the few values given in the literature. As these results were obtained by different schemes and by working with refined methods and under carefully controlled conditions, they are believed to be dependable. The limits found cannot be taken as the absolute limits of such dusts wherever they are created, because of the possible variation in size and composition of these materials when created under different manufacturing conditions. However, since these explosive limits have been worked out for typical dusts actually collected in the field and their composition and fineness have been defined, they should serve as a definite reference point for other dusts the composition and fineness of which are known, and possibly as a guide in ventilating practice.

RESULTS OF PREVIOUS INVESTIGATIONS

The literature contains many references to the flame and pressure characteristics of dust explosions of a qualitative nature, but few to the exact proportions of dust and air necessary to start an explosion.

Values of 18, 20, 33 and 35 mg. of dust per liter of air given for buckwheat, malt, barley and peas, respectively, in the report of an American consul are difficult to interpret properly, as the report fails to give the original data from which the figures were derived.

Table I shows the results obtained by other investigators. Coal dust is included for comparison.

Weinman's work was done in a tin vessel with a base 37 x 26 cm. and 123 cm. high. A motor-driven fan, mounted on a horizontal axis, kept the dust in motion. Ignition by electrical means was effected from two electrodes projecting through the walls of the vessel. No mention is made of how the dust was introduced into the chamber. Weinman states that he was unable to maintain a good, even suspension.

The four values obtained for sugar (72, 180, 270 and 370 mg. of dust per liter of air), the lowest values found in a total of 162 tests using different sources of ignition, indicate that the explosive limits depend upon the heat intensity of the ignition source.

Bauer's work on aluminum dust was performed in a chamber similar to that used by Weinman for sugar dust. Bauer added dust continuously to the chamber until the explosion occurred and called the weight added the lowest amount necessary for explosion.

Table I—Lower Explosive Limits Found in Previous Investigations

Dust	Ignition	Lower Limit	Investigator
		Mg. Per Liter of Air	
Sugar	Arc	72	
	Oil lamp	180	
	Glowing nickeline spiral	270	Weinman
	Electric spark	370	
	Heated aluminum coil	17.5	Beyersdorfer
Aluminum	Electric arc(?)	432	Bauer
Standard Pittsburgh coal dust	Flame from black powder charge	40 (possibly lower)	Rice and others

The limit found (432 mg. per liter of air) is unusually high, presumably owing to the fact that Bauer failed to allow for the great quantity of dust that must have settled out during the interval in which the dust was being added.

The value reported for sugar by Beyersdorfer (17.5 mg. of dust per liter of air) was calculated from observations made by using a very refined device which suspended the dust by puffing, as differentiated from the fanning principle used by Weinman and Bauer. This apparatus was so designed that conditions could be accurately controlled. Consequently the theory upon which Beyersdorfer bases his calculation is well supported by experimental data.

One of the weak points in any work done with dusts lies in the inability to create and maintain for much more than a second or so a fair homogeneous suspension of definite dust-air proportions approaching a gas-air mixture. In fact, there are practically only two ways to create dust suspensions of definite concentrations. One is to use concussion, or a sudden blast of air directed properly upon a weighed quantity of dust in a closed chamber; the other is to fan the dust into the air of the chamber by a stirring device.

The first method is better than the second, because by it the suspensions may be ignited at the same instant that the concussion or blast which creates the suspension

takes place, or a fraction of a second later, and before the particles start falling from the air and lowering the concentration. Although it is probably easier and may at first seem better, the second method is to be avoided. Dusts, as differentiated from gases or smokes, when driven against any surface, liquid or solid, have a persistent tendency to adhere to this surface and to one another. Further agitation of the suspension causes flocculation and precipitation from the air. If an attempt is made to suspend a weighed quantity of dust in a chamber by fanning for, say, 10 minutes, upon igniting the mixture at the end of this interval, the concentration may have been decidedly lowered.

The second method was used by Weinman and Bauer, so their results are apparently too high. Data on the chemical constitution of the dusts used and certain essential physical properties, such as particle size, are lacking in their work. This makes it difficult properly to interpret their results.

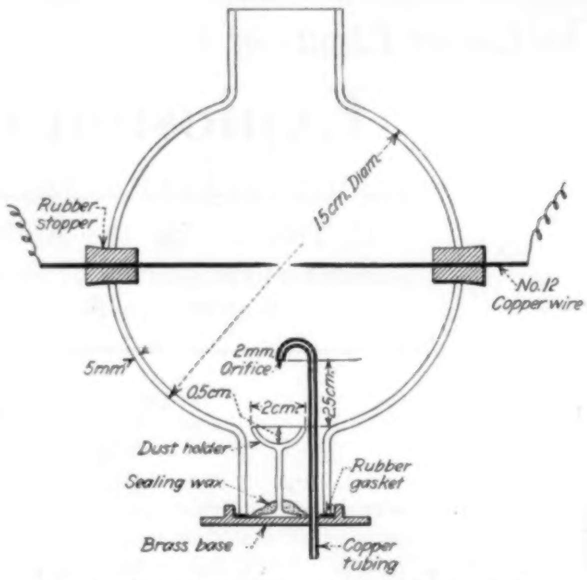


Fig. 2—Modified Clement-Frazer Explosion Bomb

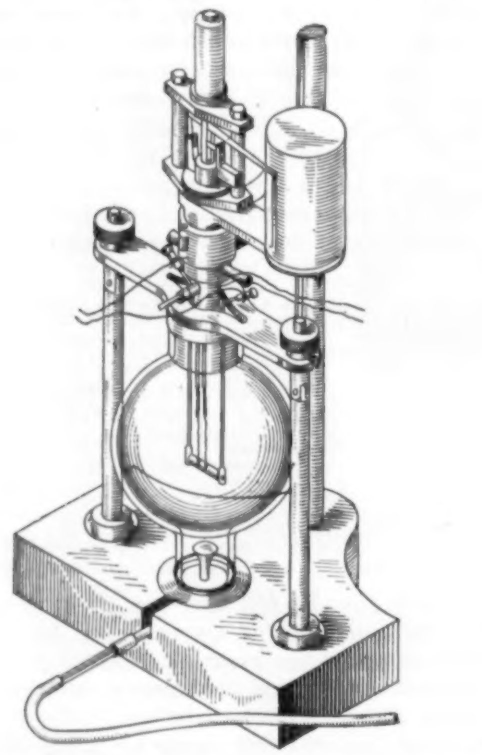


Fig. 1—Original Clement-Frazer Explosion Bomb

In successive tests decreasing measured concentrations of dust were suspended in a spherical glass 1.4-liter bomb and ignited, until a concentration was reached at which pressure and flame were no longer produced. The character of the flame was noted and the pressure was automatically recorded on a smoked paper. Three kinds of ignition were used for each of the seven dusts. Such variables as chemical composition and size of particles were kept constant by using throughout the tests the same materials, carefully analyzed, moisture free, and always screened to the same maximum particle size. All other experimental conditions, such as temperature and duration of ignition, were also kept constant.

A knowledge of ignition temperatures is essential to a study of flammable dusts and a proper interpretation of results. The Clement-Frazer apparatus, with one of the ignition sources used in lower limit work, proved to be well adapted to the determination of the ignition points. Table II gives the data thus obtained on the dusts tested.

The explosion bomb used in this work (Fig. 1) is a modified form of the Clement-Frazer "relative flammability" device originated in the Bureau of Mines for testing coal dusts. It has a capacity of approximately 1,400 c.c. and is 15 cm. in diameter. A dust-injecting device enters through a bottom tubular and an electric

Table II—Composition and Properties of Dusts Used in Tests

	Chemical Composition						Physical Properties				
	Non-Combustible		Combustible								
Dust	Moisture Per Cent	Ash Per Cent	Starch Per Cent	Protein Per Cent	Crude Fiber Per Cent	Fat Per Cent	Ignition Temperature(*) °C.	Heat of Combustion(†) Calories Per Gram	Relative Flammability(‡) Lb. Per Sq.In.	Through 200 Mesh Screen Per Cent	Per Cent
Corn starch	11.10	0.12	88.26	0.52	None	None	640	4,183	13.7	100	100
Wheat elevator	9.20	18.17	34.83	12.54	22.14	3.12	700	4,183 §	12.2	89	100
Corn elevator	7.84	13.41	67.41	6.55	3.58	1.20	625	3,667 §	12.2	89	100
Sulphur	0.05	0.36	.....	.....	.....	....	280	2,120	10.2	74	100
Crystalline 68.80 per cent											
Amorphous 30.79 per cent											
Sugar	0.04	0.01	.....	.....	.....	....	650	3,955	11.4	83	100
Pure sugar 99 per cent											
Foreign organic material 0.95 per cent											
Aluminum	0.27	.....	.....	.....	.....	....	925	7,244	13.4	99	100
95.20 (¶) per cent											
Fe, Si, Cu, Pb, Mn = 3.33											
Organic matter = 1.20											
Standard Pittsburgh coal	1.85	7.04	.....	.....	.....	....	900	7,848 §	8.7	64	87.2
Volatile matter 36.43											
Fixed carbon 54.68											

* Determined by glower ignition in bomb.
† Commonly accepted values (moisture-free substances).
‡ Referred to corn starch as 100% on basis of lbs. per sq.in. pressure in bomb.
§ Determined by the U. S. Bureau of Mines at the Pittsburgh Station.
¶ Determined by the U. S. Bureau of Standards.

Plan of the Authors' Tests

glower or igniter enters through a top tubular. The technique described by Clement, with some modifications, was used in operating the bomb in the experiments here reported. The modifications consisted in getting the dust into suspension with air instead of oxygen by blowing down from above from a fine jet (Fig. 2), substituting interchangeable electrodes through the sides of the bomb for arcing, or induction coil sparks, and using the character of the flame produced, as well as the pressure, as a basis of measurement of the explosibility of the mixture. Three types of ignition were used with the bomb—the original platinum wire glower of Clement and Frazer, a high amperage arc, and a high-voltage induction coil spark.

Table III—Results of Tests With Spherical Glass Bomb

Type	Dust			Glower Ignition at 1200 Deg. C.		Arc Ignition at 33 Volts, 5 Amperes			Induction Coil Spark Ignition at 6.5 Volts 3 Amperes		
	Weight Used: Total	Weight Used: Per Liter	Total Trials	Flame Characteristics	Average Pressure Generated	Total Trials	Flame Characteristics	Average Pressure Generated	Total Trials	Flame Characteristics	Average Pressure Generated
	Mg.	Mg.			Lb. Per Sq. In.			Lb. Per Sq. In.			Lb. Per Sq. In.
Powdered Corn Starch	75	51.0	9	Good propagation	13.7	3	Good propagation	14.0	12	Good propagation 7 times	13.7
	25	17.2	2	Good propagation	7.2	4	Good propagation	6.7	9	Good propagation 8 times	4.0
	20	13.7	3	Good propagation	5.3	4	Good propagation	4.5	2	Good propagation	3.4
	15	10.3	2	Good propagation	3.2	5	Good propagation	2.3	7	Positive flame	1.8
	10	7.0	2	Good propagation	2.1	7	Positive flame	1.0	7	Positive flame	0.7
	7	4.9	4	No flame twice Flicker twice	0.3	7	Positive flame	0.4	7	Positive flame 3 times Flicker 4 times	0.5
	5	3.4	4	Positive flame once Flicker twice No flame once	0.4	4	No effect	0.0	8	Flicker 5 times	0.0
	3	2.0	5	Flicker once No flame 4 times	0.2						
Corn Elevator Dust	75	51.0	8	Good propagation	12.2	3	Good propagation	10.1	7	Good propagation 4 times	13.3
	25	17.2	2	Good propagation	5.5	4	Good propagation	5.1	3	Good propagation	2.6
	20	13.7	1	Good propagation	4.4	3	Good propagation	4.7	3	Good propagation twice	2.3
	15	10.3	1	Good propagation	3.2	4	Good propagation	3.0	3	Positive flame	1.0
	10	7.0	7	Positive flame 6 times	0.3	7	Positive flame	1.0	5	Positive flame	0.0
	7	4.9	3	Positive flame twice	0.1	6	Positive flame	0.4	6	No effect	0.0
	5	3.4	4	Flicker once	0.0	4	No effect	0.0			
Standard Pittsburgh Coal	75	51.0	4	Good propagation	8.7	3	Good propagation	4.0		No effect found in a total of 9 trials, 3 each using 75 mg. dust 150 mg. dust 500 mg. dust	
	50	34.4	4	Good propagation	6.1	4	Good propagation 3 times Positive flame once	1.9			
	35	24.1	..	....	....	3	Good propagation twice Positive flame once	1.3			
	30	20.1	4	Good propagation	2.5	..		....			
	25	17.2	5	Good propagation 3 times Positive flame twice	1.7	7	Good propagation 3 times Positive flame 4 times	1.0			
	20	13.7	3	Positive flame	1.1	5	Good propagation twice Positive flame twice No effect once	0.5			
	15	10.3	3	Positive flame	0.8	4	Positive flame twice No effect twice	0.4			
	10	7.0	3	Positive flame	0.5	3	No effect once Flicker twice	0.1			
	7	4.9	3	Flicker	0.2						
	5	3.4	3	Flicker	0.1	3	No effect twice	0.3			
Powdered Sugar	75	51.0	7	Good propagation	11.4	3	Good propagation	9.7	9	Good propagation twice	11.3
	50	34.4	..	....	....	3	Good propagation	7.3	6	Good propagation 3 times	7.1
	35	24.1	..	....	....	3	Good propagation	6.1	8	Positive flame 3 times	2.5
	25	17.2	3	Good propagation	5.0	3	Good propagation	3.7	6	Flicker once	0.0
	20	13.7	3	Good propagation	4.3	3	Positive flame	3.1			
	15	10.3	3	Good propagation	3.0	3	Positive flame	2.1			
	10	7.0	3	Positive flame	2.2	3	Flicker	1.3			
	7	4.9	3	Positive flame	1.2	4	Flicker once	0.6			
	5	3.4	5	Positive flame	0.8	6	No effect	0.1			
	3	2.1	3	Positive flame	0.4						
	1.5	1.0	4	Flicker 3 times	0.2						
Powdered Aluminum	75	51.0	4	Good propagation	13.5	3	Good propagation	11.7	3	Good propagation	16.7
	50	34.4	..	....	....	3	Good propagation	10.6	2	Good propagation	12.0
	35	24.1	3	Good propagation	5.7	4	Good propagation	8.2	3	Good propagation	8.5
	25	17.2	3	Good propagation	4.0	4	Good propagation	7.0	5	Good propagation	6.7
	20	13.7	3	Good propagation	3.6	3	Good propagation	4.9	6	Good propagation	4.8
	15	10.3	2	Good propagation	2.3	5	Good propagation	3.8	5	Positive flame	2.6
	10	7.0	4	Good propagation twice Flicker twice	1.1	6	Good propagation	2.2	6	Flicker once	0.0
	7	4.9	5	Good propagation once Flicker 4 times	0.7	5	Positive flame	1.2			
	5	3.4	4	No effect	0.0	6	Flicker	0.3			
	3	2.1	..	....	....	8	Flicker 4 times	0.0			
	1.5	1.0	..	....	....	4	No effect	0.0			
Wheat Elevator Dust	150	100.0	..	....	....	..	....	....	3	Positive flame once	Not registered
	125	84.0	..	....	....	..	....	....	2	Positive flame once	4.0
	75	51.0	8	Good propagation	12.2	6	Good propagation	9.6	5	Positive flame once	1.6
	35	24.1	..	....	....	..	....	....	5	Positive flame once	Not registered
	25	17.2	3	Good propagation	5.2	4	Good propagation	4.8			
	20	13.7	2	Good propagation	3.5	3	Good propagation	3.9			
	15	10.3	1	Good propagation	2.0	4	Good propagation	1.9			
	10	7.0	5	Positive flame twice	0.5	5	Positive flame once	0.7			
	7	4.9	4	Positive flame twice	0.2	5	Positive flame 3 times	0.1			
	5	3.4	3	Flicker once	0.0	4	Flicker 3 times	0.0			
	3	2.0	..	....	....	4	Flicker (?) once	0.0			
Powdered Sulphur	75	51.0	6	Good propagation	10.3	8	Good propagation	10.1	3	Good propagation	9.3
	35	24.1	..	....	....	..	....	....	10	Good propagation	2.2
	25	17.2	2	Good propagation	4.3	3	Good propagation	2.6			
	20	13.7	2	Good propagation	3.4	7	Good propagation	1.5	5	Good propagation	1.4
	15	10.3	2	Good propagation	2.2	7	Positive flame	0.5	8	Positive flame 3 times	0.7
	10	7.0	2	Good propagation	1.3	7	Positive flame	0.2	6	Positive flame 3 times Flicker twice	0.4
	7	4.9	2	Positive flame	1.0	4	Flicker	0.1	6	Positive flame 5 times Flicker once	0.4
	5	3.4	3	Flicker	0.3	4	No effect	0.0	7	Flicker once	0.0
	3	2.0	3	Flicker	0.2	..	....	....	5	No effect	0.0

The results obtained in the spherical glass bomb are shown in Table III. The notations used under the heading "Flame Characteristics," resulting from observations of the explosion, have the following meaning:

Good propagation: A large flame, extending from 5 cm. to the entire width of the bomb from the ignition source.

Positive flame: A short flame, clearly visible, extending a maximum of 4 cm. from the ignition source.

Flicker: A flash, just visible, at the ignition source.

No effect: Failure to ignite or explode.

Unless otherwise noted, the flame effects occurred in every trial made. When the total number of trials are not accounted for, with one or the other of the flame characteristics, it is to be understood that these trials were negative.

What the Results Mean

The essential characteristics of a gas or dust explosion are the production of pressure and the rapid self-propagation of flame. In a dust explosion, this means that a sufficient weight of dust must be mixed with the air to permit combustion to spread from particle to particle without the continued presence of the original source of ignition. The smallest weight of dust per unit volume of air that can effect this phenomenon is the lower explosive limit of the dust.

Therefore, in deciding from the data here given just what constitutes the lowest explosive concentration, the point has been chosen where "good propagation," accompanied by a positive pressure, occurred in at least 50 per cent of the total trials made. Concentrations producing "positive flame" were characterized in general by a slight temporary flame extension and very low pressures, usually less than 1 lb. per sq.in. In other words, there was ignition, but no explosion or self-propagation of flame. Concentrations producing only a "flicker" were characterized by a mere trace of flame or pressure, and indicate that such mixtures were well below the explosive range.

On this basis the minimum concentrations that produced "good propagation," with the corresponding type of ignition used, have been taken from Table III and are listed in Table IV. The lower limit will range from the smallest value shown to the greatest, depending upon the type of ignition to which the dust was exposed.

The explosive limits in Table IV are lower than those found by previous investigators. The fact that the limits for standard Pittsburgh coal are close to those previously reported on coals by the Bureau of Mines and French Experiment Station (32 and 23 mg. per liter concentrations, respectively, on bituminous coals), however, indicates that these values are more than relative.

Effect of Various Thermal Properties

A comparison of the limits for the three types of ignition shows that the heat capacity of the ignition source has a decided effect on the limit. Therefore a definition of the type of ignition is important in any

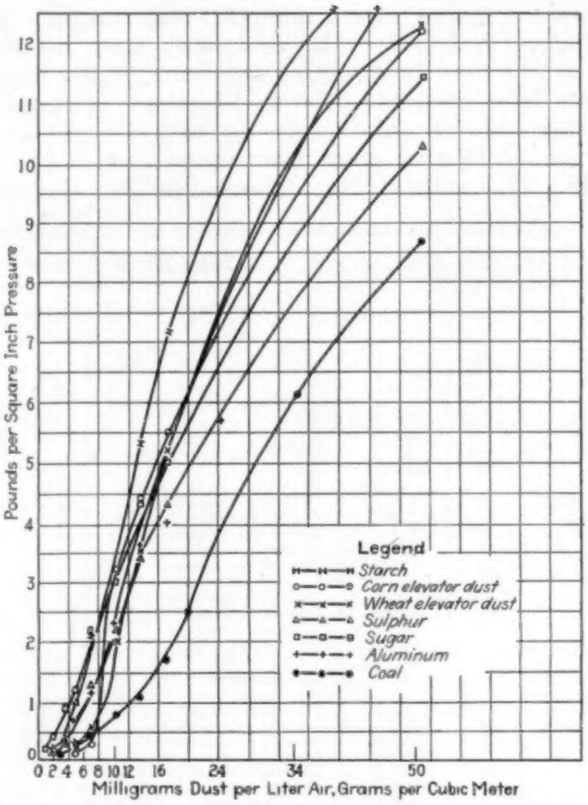


Fig. 3—Pressure-Concentration Relation With Glower Ignition

mention of the explosibility of thin mixtures. The glower had the greatest heat capacity because of its size, type of construction and method of heating, which caused the heat radiating from it to warm the air in the bomb for several minutes prior to ignition in each case. Consequently the explosive limits are lower in most cases than those for the two other types of ignition. This information verifies the reasoning that there is greater danger of ignition of a dust cloud in a plant from a large open fire (and to a smaller extent from a short circuit arc) than from a commutator or static spark.

Not only the nature of the heat applied to a dust cloud but also the thermal properties inherent in the dusts affect the lower limit. The small limit of 7 mg. per liter for sulphur can be partly accounted for by its low temperature of ignition (280 deg. C.), which allows ready propagation of flame from particle to particle, even though the heat of combustion (2,120 calories) is the lowest of all the dusts listed. Likewise the very high (900 deg. C.) ignition temperature of standard Pittsburgh coal should be expected to decrease the explosibility of the lower concentrations of this dust in air, and the glower ignition actually gave a lower limit of 17.2 mg. per liter, which is the highest value found. In contrast with sulphur dust, aluminum powder has a high calorific value and a high ignition temperature (925 deg. C.). A high heat of combustion and a flame which can be expected to exceed 3,000 deg. C. promote combustion through a thin mixture in spite of the opposing factor of an ignition temperature above the ordinary.

Added to these effects is that of the specific heats of the various substances. The organic dusts have the greater specific heat, accepting as a guide the specific heat for cellulose (0.37) and that for sugar [0.35 (0-130 deg. C.)]. The values for sulphur and aluminum are reported as 0.18 (0 - 95 deg. C.) and 0.25 (20 -

Table IV—Lower Explosive Limits

Milligrams per Liter of Air

Dust	Glower	Arc	Induction Spark
Starch	7	10.3	13.7
Corn elevator	10.3	10.3	13.7
Wheat elevator	10.3	10.3	No "good propagation"
Sulphur	7.0	13.7	13.7
Sugar	10.3	17.2	34.4
Aluminum	7.0	7.0	13.7
Coal	17.2	24.1	No ignition

508 deg. C.), respectively. The commonly accepted value for ash does not exceed 0.25. These various specific heats have their effect on the flammability of thin suspensions, since the dust cloud particles absorb heat, and their heat capacity depends on the specific heat and on the ignition temperature. If the initial quantity of heat to be absorbed is comparatively large, combustion may not take place, depending somewhat on how much heat has been generated. A comparison of the heat absorbed by the incombustible constituents with that absorbed by the flammable constituents may be drawn by referring to the heat capacities of the constituents of wheat elevator dust for temperatures below 150 deg. C., the temperature at which some decomposition of combustible matter may be expected to begin.

For 1 gram of sample heated from 20 to 150 deg.:
(Heat absorbed by 0.09 gram of moisture
$= 0.09 \times$ (heat taken by water, 20 to 100 deg. C.) + latent heat of vaporization + heat required to heat the vapor from 100 to 150 deg. C.)
$= 0.09\ (81.44 + 537 + 25.31) = 57.94$ calories

Mean heat absorbed per deg. C. $= \dfrac{57.94}{150 - 20} =$ 0.45 calories

Mean heat capacity per deg. C. for 0.19 gram of ash = 0.05 calories

Sum for incombustibles = 0.50 calories

Mean specific heat for the several organic constituents does not average more than 0.35

Mean heat capacity per deg. C. for 0.72 gram combustible = 0.25

$$\text{Ratio of heat capacities, } \frac{\text{Incombustible}}{\text{Combustible}} = \frac{0.50}{0.25} = 2$$

In this case apparently 67 per cent of the heat absorbed by the dust during the temperature rise to 150 deg. C. has been taken up by the water and ash. In accounting for differences in the explosibility of various dusts the dampening effect of moisture and ash apparently must be considered.

Effect of Chemical Constitution

The chemical composition of the cereal dusts is of interest in explaining the variation in lower explosive limits of the substances studied. The fact that corn and wheat elevator dusts, to explode, must be present in heavier concentration than starch is probably due in great measure to the large quantity of ash present in the elevator dusts (13.41 and 18.17 per cent, respectively), as compared with 0.12 per cent in starch. The difference in behavior of the two elevator dusts alone when exposed to an induction spark indicates that the crude fiber (cellulose), making up 22.14 per cent of the wheat elevator dust and only 3.58 per cent in the corn elevator dust, is not as flammable as starch.

The data give no definite general relationship between any two of the following properties: ignition temperature, lower explosive limit, relative flammability, and heat of combustion; nor can it be expected in substances of such widely varying physical and chemical properties. The relative flammability, for example, is partly dependent not only on the heat of combustion but also on the volume of the resulting products of combustion.

The series of curves in Figs. 3, 4 and 5, with milligrams of dust suspended per liter of air on the horizontal axis plotted against the average pressure developed upon explosion on the vertical axis, show the relative intensity of explosion of these dusts with different types of ignition, when the dusts are present in the same concentration—that is, "relative flammability,"

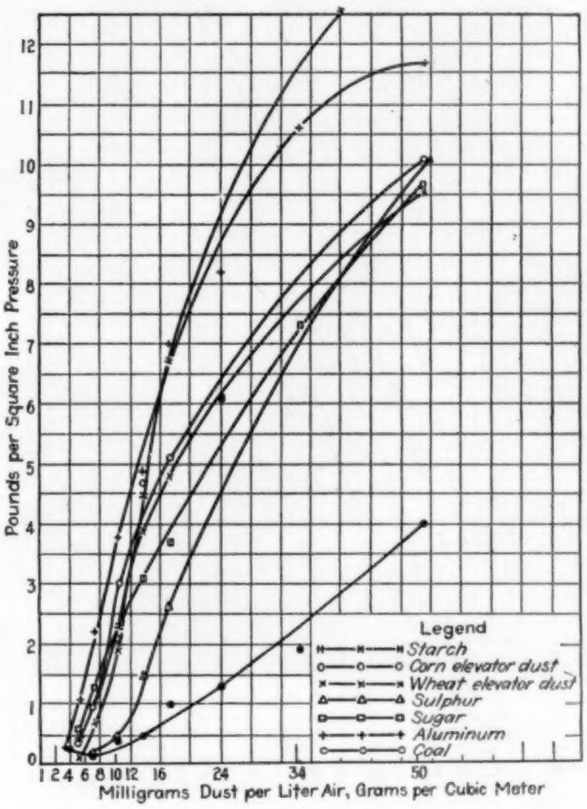


Fig. 4—Pressure-Concentration Relation With Arc Ignition

as the term has been used in the Bureau of Chemistry. The pressure rises with increased concentration and is probably directly proportional to the concentration. It would be difficult to measure the lower limit of concentration for explosion of the dusts tested by the pressure alone, because there appear to be no very abrupt changes in the shape of the curves to indicate a suddenly increased explosive effect, but rather only a steady, gradual rise. Except in one case the upper parts of the curves do not flatten enough to indicate a close approach to the dust-and-air mixture giving a maximum explosibility.

The lower limits, based on the point of diminishing flame propagation, were accompanied in general by a pressure in the bomb of 1 lb. per sq.in. or less. However, the pressures as determined on this device are not as accurate at 1 lb. or less as when much higher. Accordingly more reliance must be placed on flame observation at low dust-air concentrations as a measure of the lower explosive limits.

Regardless of the type of ignition used or weight of dust suspended, coal and sulphur generally produced the smallest pressure upon explosion, and aluminum, or possibly starch, the greatest pressures, with sugar and the elevator dusts occupying an intermediate position. This may be partly explained by the fact that sulphur produces upon oxidation only about half the volume of gaseous products of combustion that starch does, using the same weights of materials. Sulphur, therefore, is not as violently explosive as some other materials. Its lower ignition temperature and ease of becoming charged with static electricity are other considerations which make it frequently explosive, as differentiated from violently explosive. However, aluminum powder, upon oxidation, produces no gaseous products of combustion; in fact, it uses up oxygen from the air and is as violently explosive as starch. This is due, of course,

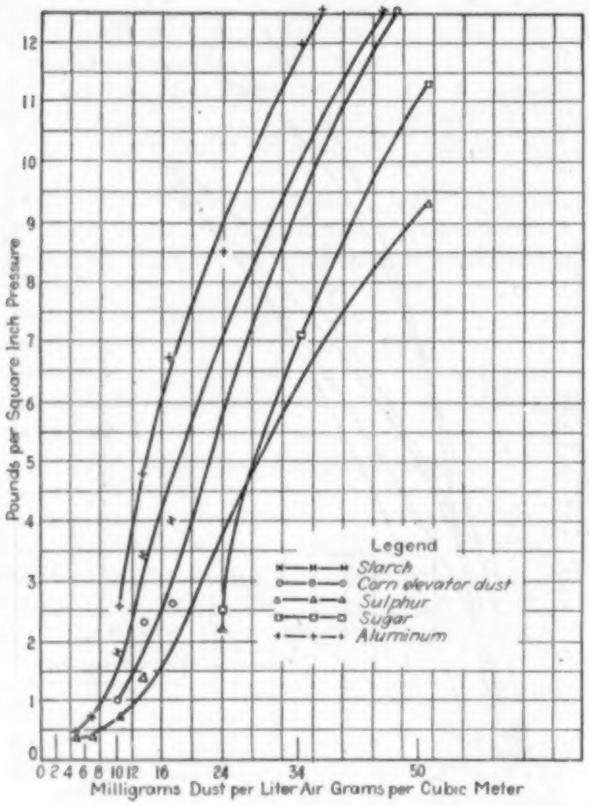


Fig. 5—Pressure-Concentration Relation Using Induction Spark Ignition

to the heat of reaction of aluminum with oxygen, which is so much more intense than a similar reaction for other materials that the surrounding air is rapidly expanded with explosive violence.

It is an interesting fact that the two dusts, coal and sulphur, which are alike in being the least violently explosive, vary widely in lower limits (17.2 mg. per liter of air for Standard Pittsburgh coal dust and 7 mg. per liter of air for powdered sulphur). There seems to be no special relation between "relative flammabilities," which are determined mainly by the volume of gaseous products of combustion and the heat of combustion, and the lower limits of concentration for explosion of dust in air.

It is expected that the work begun on a laboratory scale with refined apparatus will be repeated and continued with apparatus in which flame propagation can be obtained over several feet of distance and with which plant conditions can be more closely simulated.

New Brown Dyestuff Developed

Pontamine Diazo Brown 6G is the name of a new dyestuff recently put on the market by E. I. du Pont de Nemours & Co. It is stated that when developed with beta naphthol this new color gives a good bright brown, which should supply a much-needed shade in the present available line of diazotizable colors. In cases requiring better fastness to washing and light than can be obtained with ordinary direct colors, this color may be found well suited for the production of shades of rust brown that are in demand at the present time.

Its fastness to cold water, acids, alkali, washing, perspiration and light is said to be good, while its solubility is high enough to work well in the padder.

Tannin Survey Completed

Hide and Leather Division, Department of Commerce, Reports on Productive Capacity of Domestic Plants

THERE are thirty-one firms having forty-three plants engaged in the manufacture of tanning extracts exclusively from domestic materials in the United States. According to information obtained in the raw material survey, made by the hide and leather division, Department of Commerce, these plants have a productive capacity of 894,414,460 lb. of 25 per cent tannin extract, per year. The amount of extracts produced in all these plants during 1922 amounted to 428,515,175 lb. of 25 per cent extract, or on the basis of 47.9 per cent of their capacity. Of this total production of domestic extracts, chestnut extract accounted for 90 per cent of the total, or 387,340,732 lb. of 25 per cent extract. To produce this amount of chestnut extract 497,007 cords (160 cu.ft. to the cord) of chestnut wood was consumed.

Many of these plants are operated by tanners who consume their entire production of extract, while others are operated by tanners who sell their surplus of extract production on the market, and the remainder are operated by independent producers whose entire production is disposed of in the open market.

The amount of extract, both wood and bark, produced by consumers during 1922 amounted to 250,320,357 lb. of 25 per cent extract. The independent producers, who depend upon the open market for the distribution of their product, have a total capacity of 413,650,000 lb. of extract annually, and during 1922 the actual production from these plants was 178,194,818 lb.

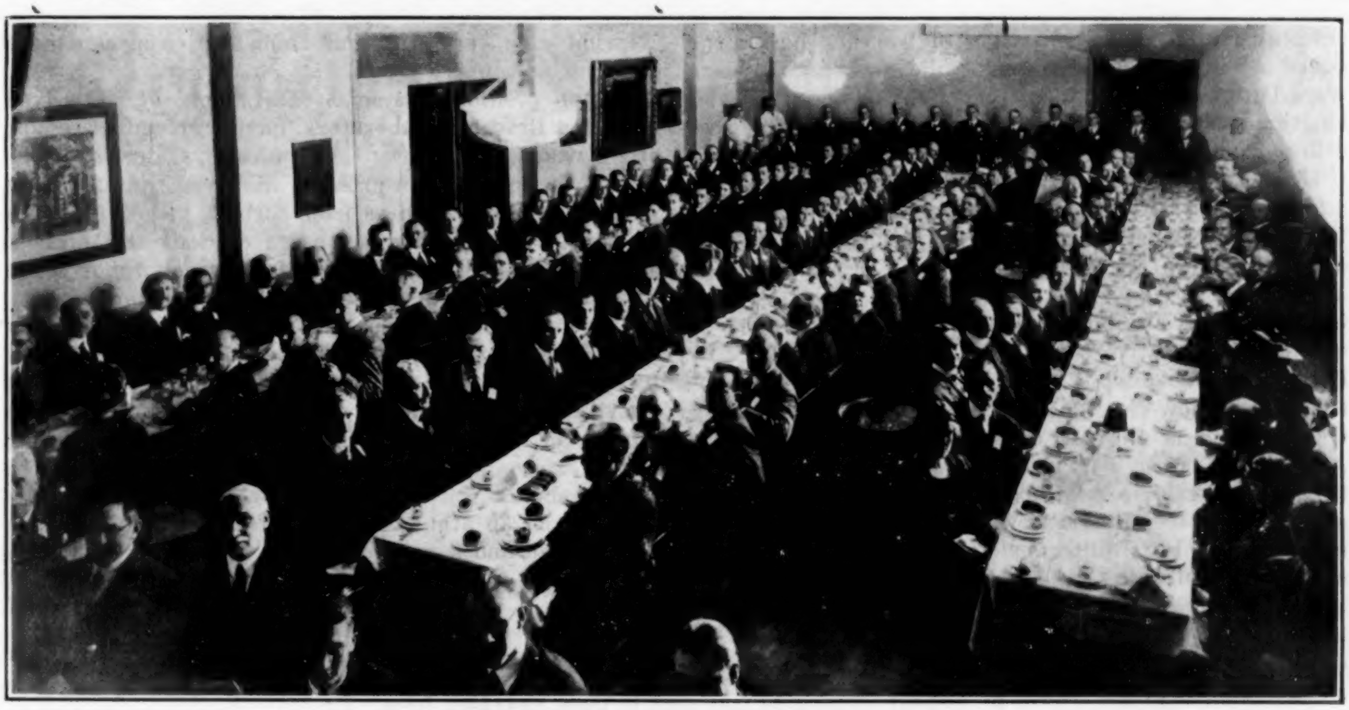
Surplus of Tanning Extracts Produced

Considering the production and consumption of domestic tanning extracts in terms of bark tons, without reference to the kind of extract, the United States had an actual production during 1922 of 446,371 bark tons of tanning extracts to apply against a consumption of 382,322 bark tons. Of this domestic production 256,509 bark tons was produced for private consumption and 189,862 bark tons was produced for sale on the open market. There was produced during 1922 for the open market a surplus of 64,049 bark tons.

The following is a summary of consumption and production:

	Bark Tons
Total consumption of domestic extracts	382,322
Total consumption of raw domestic barks, etc.	333,586
Total consumption of foreign extracts	350,517
Total consumption of foreign raw materials	118,666
Total consumption of all tanning material (barks and extracts)	1,185,091
Total production of domestic extracts	446,371
Total surplus of production of domestic extracts	64,049
Total capacity for domestic extract production	931,597

In making a survey of all vegetable tanning materials consumed in the United States it is necessary that quantities of each material consumed should be expressed in a form that will permit of easy comparison, and to meet this necessity the figures showing the consumption of different materials are expressed in the tonnage of those materials and also in terms of bark tons based on 12 per cent tannin.



Banquet of Northeastern Section, A.C.S., in Boston, Jan. 12, 1924

What Do We Know About Catalysis?

A Report of the Admirable Symposium on This Vitally Important Subject at Which the Leaders in Chemical Thinking and Research Expressed Their Views

EDITORIAL STAFF REPORT

LAST week the Catalysis Symposium held under the auspices of the Northeastern Section of the American Chemical Socity, on Jan. 11, at Cambridge, Mass., was described in our news pages. The meeting must be regarded as highly successful from any point of view; the attendance, the quality of the papers presented, the excellent discussion, the real research ideas brought to light.

W. D. Bancroft, of Cornell, acted as chairman of the meeting, and presented an admirable paper on contact catalysis. He began by pointing out that we are on the threshold of a new era in catalysis. The first era, which started with Berzelius, was that of identification, the recognition of a new type of chemical reaction. The second era was that which began with Ostwald's measurement and study of catalysis through increased reaction velocity. A third era has just passed, that of studying the intermediate steps of catalytic reaction. Was it intermediate compound or selective adsorption? Now we must face the more fundamental question, Why should either intermediate compounds or selective absorption affect reactions?

Several theories have been advanced, and there is contributory, though not confirmatory, evidence for some. The "tales-up" theory assumes that the molecules in solution are oriented, so that one side or end would be anchored, and the other free. This free end then enters into chemical reactions.

There is, however, interesting evidence from photochemistry that must be examined: Alcohol may be dehydrated with kaolin to form ethylene. The same result is obtained with an aluminum catalyst. A nickel catalyst produces acetaldehyde. All of these products, together with carbon monoxide and methane, are produced in photochemical action with ultraviolet light. Now with photochemical reactions no intermediate compounds are possible; therefore, why should we postulate them in the case of catalytic reactions in which the products are the same? This would seem to indicate the desirability of assuming some kind of dissociation perhaps into radicals.

It is even conceivable that a given organic bond corresponds to definite spectrum lines (for example, the OH group in alcohols seems to be related to a spectrum grouping). Therefore, with monochromatic light it might be possible to break up any given bond, and organic chemistry would become the chemistry of radicals.

Bancroft's speech aroused much interesting discussion. G. S. Forbes, of Harvard, pointed out the very similar energy values obtained thermochemically for the various organic bonds, and felt that a given monochromatic light would hardly differentiate. Harold Hibbert, of Yale, questioned the purity of the compound with which Bancroft was dealing, and pointed out the vastly different results obtained from benzaldehyde in sunlight with and without a trace of iodine. Bancroft, however, felt that purity was not significant in this

case, as it was only a question of whether light produced a reaction which otherwise did not go. His own work is now that of intensifying light of definite wave lengths to see whether such intensified light will give differentiated decomposition products.

H. S. Taylor, of Princeton, was introduced and spoke on negative catalysis. He first felt it desirable to prove that there was such a thing, as it has been openly doubted, so he called attention to the preservation of hydrogen peroxide from decomposition with acetaldehyde and other similar phenomena. A remarkably small quantity of negative catalyst is needed—somewhere in the neighborhood of 1 part in 10,000. The question then arises how can one molecule keep tabs on 10,000? One answer is that it doesn't. It doesn't have to. Although the ratio is large, there, nevertheless, seems to be a stoichiometric relationship between the substance and the negative catalyst if we study the reacting moles per minute. It is quite analogous to the oxidation of sodium sulphite in solution. Sodium sulphite reacts with dissolved oxygen that is present in small concentration, the ratio being about the same as that in negative catalysis. The mechanism then of negative catalysis is the competition of two molecules for a third. This was Taylor's first idea. Recently Christiansen, a Danish chemist, has offered some objections which Taylor discussed. It seems to Christiansen that the original theory presupposes a sort of intelligence on the part of the catalyst, because it selects those molecules that are about to react. It happens that most reactions that can be negatively catalyzed are exothermic or energy-rich reactions, the excess energy going to stimulate additional molecular reactions. This sets up a chain of reactions. The negative catalyst acts to break that chain of reactions. Confirmatory evidence can be derived from photochemistry. By calculating the light energy absorbed for a given rate of reaction, a relation between the light energy and the reacting molecules is obtained. It is found that in many negatively catalyzed reactions (all that have been calculated) the ratio of one unit or quantum of energy per 200 reacting molecules exists, whereas in many other reactions the ratio is 10,000 quanta to one reacting molecule. At least this relationship between compound formation and reaction energy cannot be neglected. The possibility of extending this explanation to gaseous reactions, particularly to elimination of detonation in a gas engine with antiknock compounds, was discussed, with the ayes having somewhat the better of it.

Catalysts, those mysterious substances that bring about the impossible, that make products that cannot be made in their absence, that speed up reactions without seeming to take part in them emerging from them untouched—catalysts are still but little understood. In spite of the fact that great industries are built up on catalyzed reactions, sulphuric acid, synthetic ammonia, hydrogenated oils and scores of others, we know merely how to control the reactions. We must look to these leaders of chemical thinking to discover the ways of getting at the mechanism of catalysis.

J. F. Norris, of M.I.T., closed the afternoon session with a paper on the factors determining the strength of organic valence bonds. He showed how fundamentally a given bond is affected by substitution in other parts of the molecule, as for example the different reactivity chlor and amino substituted acids. Even solvents affect not only the rate of reaction but the course of the reaction. For example, the aluminum chloride and zinc chloride addition compounds with various organic substances such as benzoyl chloride or triphenyl methyl chloride give very different condensation products in different solvents.

At the evening session A. T. Larson, of the Fixed Nitrogen Research Laboratory, gave a splendid account of the work of producing the iron catalyst developed for the synthetic ammonia process. Some of the first tests with pure metals such as iron, corbalt, nickel, tungsten and molybdenum showed that iron had the highest activity, and all of them had relatively short life. One sample of iron possessing both greater activity and longer life was prepared from tap water solutions instead of distilled water. The search was then taken up for "promoters" that would increase the catalytic activity of the material. Experiments indicate that a number of metals can be used as promoters; aluminum, silicon, zirconium, thorium, cerium, all gave a 4 per cent ammonia conversion with one pass of gas (550 deg. C. and 30 atm.). Groups of two promoters were also studied and it was found that if the two promoters resembled each other (as do barium and strontium or sodium and potassium), the increased activity is not great. On the other hand, if two dissimilar metals such as potassium and aluminum are used as promoters, both the activity and the life are notably increased. Especially is this noticeable at high pressures, where activity is apt to diminish. The commercial catalyst now contains 1 per cent potassium and 1 per cent aluminum and will give 60 per cent conversion at 1,000 deg. and 30 per cent conversion at 300 deg. Water vapor acts as a temporary catalyst poison, for a small trace of it will reduce the efficiency almost to two-thirds.

How does the promoter act to produce longer life and increased activity? The latter has usually been associated with greater active surface and with aluminum content. The gas-absorbing power of the catalyst seems to have nothing to do with its activity, nor does the ability of the catalyst to desorb ammonia seem to be a limiting factor. It is not impossible that an activation of nitrogen takes place, since nitrides are formed that are much less stable in the presence of promoters.

The final paper of the series, by C. G. Fink, of Columbia, told of some work undertaken to produce anodes insoluble in acids, particularly sulphuric, but with traces of nitric and hydrochloric, a very real problem in big copper plants. He first classed metals according to the way they corrode in acid, whether above or below the waterline or both.

Insoluble anodes have been produced by films and by controlling oxygen evolution (such as by nickel-plating iron, etc.). Many interesting facts have been observed such as the desirable effect of a small amount of barium with lead anodes, because it aids in gas polarization. Manganese has a general corrosion-resistant action, while silver, copper and cobalt have a desirable promoter action. In short, Doctor Fink concluded, by proper balance and selection you can get an anode that will resist corrosion in almost any given solution, and at the same time, by reason of the elimination of polarization, cut down the cell resistance greatly.

Importance of Chromium to the Chemical Engineer

This Metal in Various Combinations Provides Corrosion-Resisting Materials of Construction of Great Present and Future Importance

BY CLIFFORD B. BELLIS
Assistant Editor, *Chem. & Met.*

IT IS almost impossible to exaggerate the importance of the place that chromium is taking in the industrial world. Chromium's day has come, and it behooves the engineer who would not fall behind in the march of progress to give more than momentary attention to the spectacular climb of this metal into first-magnitude prominence.

Chromium has, of course, been used for many years and it has been studied in many industries, in the laboratory and in the plant. The result has been an increasing knowledge of its peculiarities in many diverse directions. Its development is now at that point where the widely scattered information obtained by investigators along different lines begins to fit together, presenting a continuous picture in which can be seen, all at once, a number of new possibilities.

Chromium the metal has no important industrial application except in combination with other metals. But it is a necessary constituent of alloys so numerous and of such industrial value that it would hardly be too much to say that chromium is indispensable, a key metal.

The most important alloys containing small proportions of chromium are the chromium steels. These contain up to 8 per cent of chromium, often in combination with other alloying metals. Stainless steel is also, of course, a chromium steel, but due to its higher content of chromium and its particular importance to the chemical engineer, it will be considered separately a little further along. In general, the function of chromium in alloy steels is to increase hardness and strength without any sacrifice of toughness and ductility. Heat-treatment will increase either the hardness or the toughness of a piece of steel, one property at the expense of the other, but chromium will do both at the same time. The widespread use of chromium steels is so well known and they have been used for so many years that familiarity with them has bred contempt to a certain extent. It is worth remembering in this connection, however, that without these steels the weight of the automobile engine would be so great as to make a powerful car a clumsy thing and the airplane as we know it an impossibility, two merely incidental points, but points typifying the vast importance of chromium steels to modern industry. A small percentage of chromium is one of the important components of high-speed tool steels. It has been said that Henry Ford's plant would need to be seven times its present size to maintain its enormous production without the use of high-speed steel tools. While this figure is possibly a slight exaggeration, it provides an illustration of chromium's importance in a different capacity.

Steels containing 10 to 15 per cent of chromium come under the heading of stainless steel and rustproof iron. These are the commonly accepted names for a large group of 15 per cent chromium alloys produced by many manufacturers and sold under many varying trade names. Stainless steel and rustproof iron differ principally in carbon content. Stainless steel contains ordinarily 0.3 per cent or more of carbon, while the carbon content of rustproof iron is usually well under 0.1 per cent.

Stainless steel has been for several years a familiar product, due principally to its wide use for cutlery. It is an excellent resistant to the more common organic acids and to atmospheric corrosion when it has been properly hardened. The occurrence of these properties in a metal of great tensile strength is obviously an advantage of no small magnitude. The breadth of its possibilities of application is indeed great. Its great strength acquired by heat-treatment is retained to a considerable degree at comparatively high temperatures where resistance to oxidation is also maintained. It provides a material of construction with applications of obvious importance too numerous to mention. A typical instance is its value for poppet valves in internal combustion engines. It is claimed by at least one manufacturer that a small percentage of silicon greatly improves the performance under these circumstances, and this claim seems to be substantiated by the fact that this manufacturer has succeeded in acquiring as regular customers the makers of several well-known automobiles and tractors. The conditions under which a valve must stand up in a tractor are particularly harassing to the maker.

Rustproof iron is not yet as well known as stainless steel, because it has not been on the market in any considerable quantity for so long a time. Only recently has it become possible to produce this metal with facility on a commercial scale, because ferrochrome with a very low carbon content is necessary for its manufacture. The development of ferrochrome has only lately reached that point where the manufacture of rustpoof iron can truthfully be called a commercial success. Rustproof iron is tough but very ductile and consequently can be cold worked and otherwise handled like a mild steel. The importance of this should not be overlooked.

It means that it can be rolled into sheets, drawn into wire or seamless tubing, and pressed into sheet metal hollow ware of various forms. It is easily forged and

readily machined. In contrast to stainless steel, it has an excellent resistance to corrosion in the manufactured condition without further heat-treatment.

The uses of rustproof iron have until recently been somewhat limited by its high price, but already it is an important competitor of copper for roofing and similar applications. This brings us to a consideration of the present peculiar situation of stainless steel and rustproof iron in regard to price, supply and demand. Consumers are saying that if the price is decreased they will use large quantities of these materials. The manufacturers say that if the consumer will use large quantities of these materials they can make them at a much lower price. The condition of the market is very unstable and we may expect that a radical change in the situation will take place quite suddenly some time in the future. There will then be a jump to larger scale production accompanied by a corresponding drop in price. The manufacturers expect this and will probably be prepared for it. This, with other cost reductions which research will undoubtedly bring, makes it quite reasonable to expect that stainless steel and rustproof iron will be much used in the future for structural purposes. They have already been used for such purposes as the building of a submarine. Such cases as this are, of course, experimental and the price is not a determining factor. But when the cost of production of these metals is brought down to a reasonable figure, it is not too much to expect that such applications will emerge from the experimental stage. If the amount of money spent in preventing corrosion on the Brooklyn Bridge could have been applied to the use of a stainless steel in the first place, it is quite conceivable that money would have been saved in the long run.

There are one or two very important precautions for the users of stainless steel and rustproof iron. If these metals are to resist corrosion, every vestige of oxide must be removed from the surface; and the high-carbon material, if it is to be really stainless, must be in the heat-treated condition. The smallest particle of rolling or forging scale on the surface of one of these metals provides a starting point for electrolytic action which, once started, will proceed rapidly.

The factor that determines the resistance to corrosion of these metals is the concentration of chromium in the solid solution of chromium in iron. The chromium in these metals divides itself between this solid solution and another component, chromium carbide. The lesser corrosion resistance of stainless steel is accounted for by the presence of an increased percentage of carbon, which, combining with some of the chromium, leaves a lower concentration of it in the chromium-iron solid solution.

Nickel-Chromium Alloys

The alloys of nickel and chromium, especially those containing from 10 to 20 per cent of chromium, have for many years provided a material of construction of immense value to the industrial world. Their most important feature is their great resistance to the ordinarily damaging action of high-temperature processes. These metals are almost unexcelled in their ability to maintain their strength and stiffness at high temperatures, and their resistance to hot oxidation by gases is remarkable.

Most young chemical engineers probably first made the acquaintance of one of these alloys in the laboratory in the form of a Nichrome triangle. The variety of application of these metals throughout the industries has been increased during the last 15 or 20 years until they have become familiar necessities. Probably their greatest use at the present time is for the resistance elements in electric furnaces and as castings for pots used in heat-treating steel. For carburizing pots it is probably safe to say that they lead the field. One reason for this is the lack of iron in their constitution, which prevents the pot itself from being carburized and consequently deteriorated. This field is one of great extent and importance, automobile manufacturers alone requiring enormous quantities of these pots. But nickel-chromium alloys have one important industrial disadvantage—they are expensive. In large plants where first cost is not so important as ultimate saving they are held in high regard, and while lower cost per heat hour is claimed for other alloys, such claims are hard to prove except under some given set of circumstances. The Marsh patents covering these nickel-chromium alloys expired about a year ago (February, 1923) and these metals are consequently coming into wider use than ever before.

The reason for the corrosion resistance of high-chromium alloys is an interesting one and explains to a considerable degree the great industrial value of the nickel-chromium alloys and the chrome irons yet to be described.

When the chromium content is above the order of 15 per cent and particularly when it is about 21 per cent or higher, the scale formed by initial hot oxidation is tough, non-porous, tightly adhering, and very nearly —in some cases exactly—of the same coefficient of expansion as the metal. Such a combination of properties seems like a special dispensation of Providence, especially when the extreme chemical resistivity of this coating is appreciated. To fail to take 100 per cent advantage of such a combination would seem to be the height of folly. It has been taken advantage of in the case of the nickel-chromium alloys and undoubtedly if will be in the case of the chrome irons when engineers' attention is called to the possibilities of these comparatively new metals. A very important feature of them is their comparatively low cost, it being far below that of the nickel-chromium alloys.

The Chrome Irons

As far as records show chrome irons were first produced as materials of construction about 1910. Frederick M. Becket was doing some work—he would probably call it a laboratory experiment, but it was on a scale that would require a most "industrial" looking laboratory—which required a most refractory metal.

Why Should You Be Interested In Chromium?

Authorities agree that the part chromium is going to play in the arts in the next few decades is of the first magnitude. This story about chromium gives some of the interesting points in the development of the metal, but its real purpose is to stress the possibilities of chromium and to call the attention of chemical engineers to the fact that this metal will in the near future surely find important applications in the chemical engineering industries. If he would not miss any opportunities, he will keep in step with the reduction to practice of chromium's promises.

He had at hand a supply of ferrochrome containing about 60 per cent of chromium and it occurred to him to reduce the chromium content by steps in order to obtain a metal with sufficient resistivity for his purpose and which could be cast with facility. He found that when a 20 to 30 per cent chromium alloy was produced he had obtained the metal he needed. He made no secret of his results and chrome-iron castings were soon afterward put on the market by at least one manufacturer and have been used in the industry to great advantage.

Becket saw the great industrial possibilities of the chrome irons and began experimenting, one of the objects being to make possible the manipulation of these metals in other ways than by casting. It was obvious that their field would be greatly broadened if they could be rolled, forged, drawn and otherwise mechanically worked. Experimentation was stopped by the war, to be resumed after the armistice, which accounts for the fact that only comparatively recently has it become possible to apply these valuable metals over their new broad fields.

A full list of their applications would probably become obsolete in a few months, for these chrome irons have reached that point in their development where their possibilities are being recognized by the industrial world and wide-awake engineers are looking for opportunities to take advantage of them in their own plants. Here, however, are just a few typical applications of the chrome irons which should provide the chemical engineer with hints regarding possible uses of these metals in improving the efficiency of his own plant:

Retorts for oil cracking or for low-temperature distillation of oil shale or coal.

Linings for apparatus for treatment of oil refining residue.

Burner parts.

Heat exchangers.

Autoclaves, digesters, piping.

Pump parts, valves, etc., for handling such materials as acid mine water.

A very valuable property of the chrome iron which depends on a feature of the protective coating that has not yet been mentioned is their resistance to the corrosive action of molten tin, zinc or brass. This particular chemical resistivity is due to the fact that the chromium oxide of the coating is not reduced by these metals. The chrome irons are the only cheap materials that will resist this action, and their value in this regard will undoubtedly have a great influence on the design of future furnaces for melting these metals.

Chrome-iron sheet cannot be hammer-welded, but welds readily by the gas and arc methods. Consequently it becomes a convenient material for the construction of stills, retorts and similar apparatus. A word of warning is necessary in this regard. After bending and welding, the metal should be carefully annealed before being subjected to mechanical strain or abrupt temperature changes. When this sheet was first put on the market about a year ago, the writer had an unfortunate experience from failure to take this necessity into consideration. A sheet chrome-iron vessel that was made became so brittle from the cold work of shaping it that it was completely shattered on the first attempt to use it. The methods of working chrome iron are now pretty well standardized, however, and the manufacturers are ready to give all the information necessary to manipulate the material successfully.

A property quite unrelated to those described so far is the ability of chrome iron having a high carbon content to resist abrasion. This high-carbon material will not withstand severe shock, but for abrasion-resisting purposes, where it is not necessary to stand up against sharp blows, it proves very effective. Little use has been made of this property up to the present time. One reason for this is that the chrome irons are sold by dealers who have to date concentrated on selling them for corrosion resistance, which means that they have been reaching quite a different body of consumers from those to whom abrasion resistance is an important factor.

Metallic Chromium

Metallic chromium of a high degree of purity is now being made in the electric furnace. Probably its most important uses are in the manufacture of chromium wire and as an anode in chromium plating. The fact that it has just about the same coefficient of expansion as platinum makes it an excellent substitute for the latter metal for sealing into glass for contact with the interior of vacuum tubes or incandescent lamps. Malleable chromium wire is now being made as a result of the researches of Dr. E. R. Richardson of the Westinghouse company. This malleable wire is made by chromium plating a copper wire, drawing down, replating, redrawing, and repeating these operations until the copper core is of a negligible cross-section.

Chromium which has been electrolytically deposited, though hard, is malleable, while chromium as most of us have seen it is an exceedingly brittle substance. The principal reason for that brittleness is the very high temperature at which cast chromium has always been produced, a long time at a high temperature being conducive to grain growth and consequent weakness. A contributory reason is the presence of occluded gas and oxide. By means of the carbon resistance furnace chromium can now be cast so as to be fairly malleable. The necessity of using such high temperatures in casting chromium is due not so much to a high melting point as to the great viscosity of the molten metal for several hundred degrees above that melting point.

Chromium plating, while it is as yet hardly a commercial process, has now been done very successfully. A great current density is used and the consequent large volume of hydrogen continually evolved at the cathode apparently provides the conditions necessary for success by preventing the chromium from oxidizing back and going again into solution. Chromium plating has been found to give protection in many cases where nickel and other protective coatings have failed. The chromium plate is hard and cannot be buffed or otherwise polished. This is more than made up for by the fact that if a polished surface is plated the resulting chromium surface will have a polish, without further mechanical treatment.

The ability of these chromium alloys to resist corrosion is even exceeded under certain circumstances by chromium-plated steel. The writer has seen this combination stand up perfectly under rigorous attempts to corrode it and is most enthusiastic for its future. There seems to be no doubt of its great value to the chemical engineer.

There is one important shortcoming of chromium and all of its alloys. They will not resist the action of hydrochloric acid. If you must combat the effects of this particular liquid, you may not look to chromium for help.

How Wood Is Treated

Brief Description of the Standard Processes for Wood Preservation

COMMERCIAL wood-preservation processes are concisely summarized in the following article, reprinted from the November, 1923, issue of *Wood Preserving News*, the official bulletin of the American Wood-Preservers' Association, 1146 Otis Building, Chicago, Ill.

To be effective the preservative must penetrate the timber. The commercial treatment of wood is accomplished by the use of pressure, and impregnation under pressure is the only satisfactory means of injecting the preservative into wood. While the various pressure processes differ in details, the general principle is the same in all cases. By the use of pressure, the penetration of the preservative is so controlled that the amount of preservative and depth of penetration may be varied with the requirements, thus resulting in the most economical use of the preservative.

A wood-preserving plant consists essentially of one or more treating cylinders or retorts, 6 to 8 ft. in diameter and about 120 to 150 ft. long, capable of withstanding a working pressure of approximately 200 lb. per sq.in. In the cylinder is a track for the tram cars which carry the timber to be treated. These cars are handled in trains, and by means of small locomotives are shoved into the retort, the cylinder door closed, and after preservative treatment, as described below, the cars are removed and the treated material loaded for shipment. In addition to the treating cylinders, the plant equipment includes storage and measuring tanks, pressure and vacuum pumps and facilities for seasoning the timber by steaming when necessary.

The pressure processes for the treatment of wood are grouped into two classes: (1) Full-cell process, the object of which is to fill the intercellular spaces of the wood as completely as possible with the preservative, and (2) empty-cell process, the object of which is to secure as thorough and deep a penetration as possible with the use of a minimum quantity of preservative.

Full-Cell Processes

When the preservative used is creosote, the full-cell treatment is known as the Bethell process; when zinc chloride is used, as the Burnett process; and when a mixture of zinc chloride and creosote is the preservative, as the Card process. In all these processes the methods used are very much the same.

In the Bethell process, after the material is placed in the cylinder, a vacuum of about 22 in. is usually maintained until the wood is as dry and free from air as practicable and then without first breaking the vacuum the cylinder is completely filled with the creosote oil. The vacuum not only accelerates the entrance of the preservative into the retort but also makes it possible to force the preservative into the timber more quickly and with less pressure than is the case when the preservative must displace or compress the air in the wood. After the retort is filled, additional creosote is forced into the cylinder by means of pressure pumps, the pressure being gradually raised to and usually maintained at not less than 125 lb. per sq.in. at a temperature of approximately 180 to 220 deg. F. until the required amount of the preservative has been forced into the wood. The pressure is then released, the oil drained from the cylinder and as a rule another vacuum drawn. The object of this final vaccum is to remove the surplus creosote from the surface of the timber and hasten the dripping so that the treated wood can be removed from the cylinder as soon as possible. The final vacuum also makes the wood drier on the surface and cleaner to handle. A final vacuum was not used in the original full-cell process, but was adopted later after the development of the empty-cell process.

In the Burnett (zinc chloride) process the seasoned timber is usually subject to live steam at a pressure not over 20 lb. per sq.in. for from 1 to 2 hours. After steaming is completed, a vacuum of approximately 22 in. is maintained as in the Bethell process and zinc chloride in the form of a 2 to 3 per cent solution run into the cylinder without first breaking the vacuum, until the cylinder is filled. The treatment then proceeds as in the Bethell process. With the Burnett process 0.5 lb. dry zinc chloride per cu.ft. of timber treated is considered standard practice.

In the Card process the treatment is similar to the Burnett process. The preservative mixture is usually creosote and zinc chloride in the proper proportions so that the timber receives an absorption of 0.5 lb. of dry zinc chloride and about 3 lb. of creosote per cubic foot. The preserving fluid is made up of 15 to 20 per cent creosote and the remainder of a solution, containing 3 to 5 per cent dry zinc chloride, kept agitated in a mechanical mixture by means of a centrifugal pump attached to the treating cylinder.

Empty-Cell Processes

The "empty-cell process with final vacuum" or the "empty-cell process with initial air pressure and final vacuum," commonly called the Lowry and Rueping processes respectively, are the standard empty-cell processes. In these processes the creosote is injected into the timber under pressure until refusal or until at least a deep and uniform penetration has been obtained, and then a portion of the free oil in the wood cells is removed, leaving as the final retention less oil per cubic foot than was originally injected into the timber.

In the Lowry process the preliminary vacuum is not applied. The creosote is pumped into the timber and the pressure gradually increased until sufficient oil is injected. The pressure is then released, the oil drained from the cylinder and a quick final vacuum drawn. The air naturally existing in the wood with the help of this final vacuum forces out the excess creosote after the pressure period.

In the Rueping process a vacuum is not drawn preliminary to admitting the oil, but on the contrary air is pumped into the cylinder and thus into the wood under considerable pressure; then while this air pressure is maintained creosote oil is pumped into the cylinder. As the oil enters, the air is gradually released from the cylinder, but without allowing the pressure to drop. In this way the cylinder is filled with oil, but a considerable quantity of air is entrapped in the wood. More oil is now pumped in and the pressure increased. After sufficient creosote has been injected the pressure is released, the oil drained from the cylinder, and a final vacuum applied. This reduction in pressure allows the air entrapped in the wood to expand and force some of the oil out of the wood.

Only sound wood should be treated, and while complete penetration of the preservative is not necessary, a relatively deep and uniform penetration is desirable.

The Rôle of Adsorption in Petroleum Refining

How Fullers Earth and Similar Adsorbents Make Possible the Commercial Purification and Bleaching of Gasoline, Kerosene and Lubricating Oils

By H. L. Kauffman
Petroleum Technologist, Parco, Wyo.

TO PRODUCE marketable products from crude petroleum requires the application of many of the fundamental processes of chemical engineering, including chemical as well as physical operations. Although a number of important steps in the refining process are essentially chemical in character, there can be no doubt that those depending upon physical action, such as distillation, filtration, fluid flow, heat transfer and adsorption, form the supporting framework for the great industrial structure.

It is the writer's intention to confine the present paper to the refining of petroleum products by adsorption or colloidal methods. The sulphuric-acid treatment has already been very well discussed recently in the article by C. J. Von Bibra in *Chem. & Met.*, vol. 27, No. 2, and this phase of the refining operation will not be considered here.

Adsorbent Materials

Fullers earth is the most widely used of all adsorbents. It has been developed in this country in Florida, Georgia, Arkansas, Texas, California, Alabama and Massachusetts, but it is also found in appreciable quantities in at least ten other states. At the present time Florida leads in production, with Georgia second. A chemical analysis is not indicative of the value of the earth as a decolorizing agent, and the extent to which it will remove color from an oil can be determined only by actually filtering oil through the earth in the laboratory.

Animal charcoal, wood charcoal and various of the newer activated carbons, as well as other forms of carbon of high purity, are used to a limited degree in the petroleum industry. Acid-treated clays are finding a more extensive use in the industry than heretofore, and because of their increased efficiency over Florida fullers earth and the usual types of adsorptive clays, we can undoubtedly expect to see them more widely used in the future. Thus far their use has been limited more to refiners on the Pacific coast, where "contact filtration" (that is, the mixing with the oil of finely divided clay, heating and agitating and subsequently removing the clay from the oil by the use of filter presses of a suitable type) is employed more often than elsewhere.

> ***ADSORPTION***
>
> **This article deals not so much with petroleum refining as with the principles that underlie the unit process of adsorption. These find equally important application in the bleaching of vegetable oils, the clarifying of sirups and similar liquids and in the refining of many organic chemical products.**
>
> ***A UNIT PROCESS OF CHEMICAL ENGINEERING***

Halloysite, pyrophillite and montmorillonite are the three main types of California clays that have thus far been found to subject themselves readily to an acid treatment. Although in their raw state these clays have little or no decolorizing or deacidifying value, after acid treatment clays of high adsorptive value result.

Among the artificially made products that are commanding attention as adsorbents is Silica-Gel. The word "gel" does not accurately suggest the physical nature of the material, but rather refers to its condition at one stage of its manufacture. As actually used, it is a hard, glassy material with the appearance of a clear quartz sand and chemically very nearly 100 per cent SiO_2. It is claimed that the thing that differentiates this material from ordinary sand is its highly porous structure and especially the size and uniform arrangement of these pores. The material is especially adapted to the refining of gasolines and kerosenes, in view of the fact that it seems to have the ability to remove sulphur compounds by selective adsorption. In the writer's opinion, however, it is doubtful whether it can economically compete with other chemical and physical methods for the refining and purification of lubricating oils.

Purpose of Adsorbents

Generally speaking, it may be said that adsorbents are used in order to make more valuable, by increasing their useful qualities, petroleum products undergoing such treatment. Specifically, adsorbents decolorize the oil by separating solid suspended, colloidal and dissolved impurities such as small particles of coke, finely divided and colloidal carbon, complex tarry compounds of high molecular weight, dissolved coloring matter, as well as traces of suspended alkali, acid and moisture. Paraffine hydrocarbons are also removed to a limited degree by certain adsorbents, and upon this fact are based several processes that are now in the development stage. The removal of wax is of particular importance in the manufacture of lubricating oils, where the market value of the finished product is increased by removing the paraffines and thus lowering the cold test, or the temperature at which the oil will flow in cold weather.

In the refining of gasoline, kerosene and other light oils adsorbents are used mainly only in so far as it is necessary either to improve the color or to remove such objectionable sulphur compounds as hinder the ready marketing of the product. The treating of light oils with fine clay is a practice followed extensively by California refiners and to a limited degree elsewhere. Acid-treated clay is particularly adaptable for this use. Percolation through fullers earth is a procedure frequently employed in preparing for the market satisfactory mineral seal oils, long-time burning oils and other oils of a similar type.

Many arguments are advanced both for and against the extensive refining of lubricating oils by filtration. It is the opinion of some investigators that as the oil is decolorized by the action of the clay certain constituents in the oil that improve its lubricating value are also removed. Whatever the truth of the matter, the fact remains that the public continues to demand lubricating oils of light color. Where the lubricant encounters water conditions, an oil that separates readily from water is essential. If the product has been acid treated, as is most frequently the case, filtering to a

light color insures the more complete removal of those compounds that cause emulsification, and there will therefore result a lubricant that will be better fitted to serve its purpose in the presence of water.

High Adsorptive Power of the Hydrosilicates

The great adsorptive power of the hydrosilicates depends primarily on their internal structure. Gurwitsch has found by a comparative examination of finely ground Floridin in ordinary and in polarized light that even the smallest particles of the finely ground earth are not massive but possess a very fine microstructure, and that it can be considered as practically certain that the inhomogeneous Floridin particles are honeycombed with innumerable microscopic canals that bring about an enormous increase in the adsorptive surface. Gurwitsch further believes that the power of adsorption belongs to a large extent to the amorphous part of the hydrosilicate, basing this assumption on the fact that purely crystalline calcium carbonate, although its individual parts are much smaller than those of Floridin, nevertheless, at least in regard to petroleum, has very little adsorptive power; likewise barium sulphate and other very finely crystalline powders are of little value in so far as the decolorization by adsorption of petroleum products is concerned. Of interest in the above connection is the opinion of Porter that the clarifying action of fullers earth is due chiefly to the presence of colloidal silica. Maynard and Mallory (*Chem. & Met.*, 1922, vol. 26, p. 1074) believe that the bleaching power of fullers earth, like many other colloid peculiarities, is due to a combination of adsorption and mechanical filtration, accompanied by some chemical disintegration due to selective adsorption. These writers also state that active constituents of the earth are probably hydrous silica and hydrous aluminum silicates; and that the porous nature of the earth is due to the fact that it is built up of grains approaching colloidal size.

The "tempering" of the various hydrosilicates is likewise a matter worthy of attention. Many hydrosilicates attain their highest efficiency after a slight burning, in which not only hygroscopic water but also part of the water of constitution is driven off. Too strong a burning, on the other hand, is very harmful, probably because of the melting and sintering of the particles. Other types of hydrosilicates require no burning and even no drying. Gurwitsch states that several types of frankonite even function better if small quantities of water are added to the oil that is to be refined.

Usually, however, the earths (particularly those of coarse mesh) are dried at temperatures ranging from 500 to 900 deg. F. The different earths require different temperatures for bringing them to their maximum efficiency. Generally, less dependence is placed by the refiners on the temperatures attained in "tempering" than on the color of the earth, the preferred color having been determined beforehand by comparative filtrations with samples ignited to various colors.

Have you ever attempted to resolve your industry into terms of unit processes? If you have, you probably found that somewhere along the line adsorption plays an important part. Fullers earth is the principal adsorbent discussed in this article, yet its use in petroleum refining does not differ greatly from that of other materials of wide industrial utility.

Day has found the statements of Charles L. Parsons (Bureau of Mines Bull. 71, p. 6), that the water of composition is not an essential factor in the bleaching power of all fullers earth; and that some decolorize equally well both before and after the removal of water, while others lose a considerable part of their bleaching effect when their water is evaporated, to be largely correct with many though not with all oils.

Adsorbent Refining of Light Oils

Ordinarily, in the refining of most gasoline and kerosene the chemical treatment is the one of most importance given to these lighter petroleum products and the use of an adsorbent is unnecessary. Frequently, however, particularly in the refining of pressure still distillates and such distillates as result from the processing of California and Mexican crude oils, it is advisable to follow the chemical treatment by treatment with an adsorbent. Fullers earths or acid-treated clays are the materials most frequently used. The purpose of the use of the adsorbent is to improve the color and odor of the oil thus treated, although in a few cases the sulphuric-acid treatment, without neutralization, is followed either by filtration through coarse fullers earth or by agitation with finely divided clay; by such a procedure the clay either partly or completely deacidifies the acid oil in addition to removing certain coloring constituents.

Where an adsorbent is used in the refining of either gasoline or kerosene, the method most frequently followed is to apply the finely divided material to the oil in the agitator and then blowing with air for a short time in order thoroughly to mix the clay and the oil. In most cases the clay is allowed to settle out and the larger portion of it removed from the bottom of the agitator. Such a procedure, however, involves relatively large oil losses. A few refiners, who are extensive followers of this method of treating light oils with clay, make use of pressure filter presses of a suitable type to remove the oil completely from the clay. Oil losses by this procedure are therefore practically negligible. The quantity of clay used depends mainly upon the color of the oil before the clay treatment and the extent to which the oil is to be refined. Occasionally, in refining kerosenes and long-time burning oils, and more particularly in the preparation for the market of mineral seal oils, such oils are percolated through a column of fullers earth. Such a method is followed by many refiners when it is impossible to get the desired color by the sulphuric-acid treatment; by other refiners, even though the color is good, the oil is thus filtered in order to remove certain compounds resulting from the acid treatment that are believed to be detrimental to the burning qualities of the oil.

Adsorbent Refining of Lubricating Oils

In the refining of lubricating oils the treatment of the oil with adsorbing substances can be carried out in two ways: (1) by filtration through a column of the coarsely ground material; or (2) by the so-called "contact system" of mixing the finely divided adsorbent with the oil and subsequently removing the clay by the use of suitable filter presses.

Any desired degree of refining can be obtained by either method, and the choice between them depends only on practical conditions. The first thing to be considered is whether the whole filter product is desired in one particular quality, or whether it is more advisable to have it divided into several fractions of

various degrees of refining. In the first case contact filtration would be most appropriate, while in the second filtration through a column of the coarse earth would be most advisable.

The most important advantage to be gained by contact filtering, as opposed to percolation, is the time saved, due to the greater speed in obtaining the same decolorizing results. A second advantage, and the cause for the growing prominence of this method of using adsorbents, lies in the fact that it makes possible the use of finely divided acid-treated clays, which have proved to be several times as efficient as the same mesh of Florida fullers earth. Such clays cannot be used in a coarse state, because of the fact that they fuse and sinter when ignited to high temperatures, and thus cannot be revivified by the application of heat. They are therefore limited in the decolorization of petroleum products to their use as a fine powder and revivifying, if so desired, by extracting the adsorbed impurities with suitable solvents.

Coarse vs. Fine Clays

Adsorption, and particularly the adsorption of colored bodies, proceeds much faster when the clay is used as a fine powder than when coarse clays, such as 15-30 or 30-60 mesh, are used. When the clay is used in a finely powdered form, the adsorption rate (if time is plotted on the abscissa and the corresponding degree of adsorption on the ordinate) is of a logarithmic nature—that is, a curve so plotted shows that in the beginning the rate of adsorption drops quickly, but then, depending on the circumstances, it takes a more or less sudden bend and approaches, with a slight slope, the abscissa asymtotically.

The advantage of ordinary filtration—that is, percolation through a column of coarse fullers earth—consists in a more complete utilization, or what amounts to the same thing, the use of less adsorbent in order to obtain a certain degree of decolorization. This statement, however, is limited, according to Gurwitsch ("Wissenschaftliche Grundlagen der Erdölbearbeitung," 1912), by the following two conditions: Let us first understand that in cases of reversible adsorption, the phenomonon of adsorption can be represented approximately quantitatively by the so-called "adsorption isotherm" of Freundlich

$$\frac{x}{m} = K\text{-}C^{p}$$

where x denotes the quantity adsorbed, m is the quantity of adsorbent, c is the concentration of the solution being acted on, while k and p are constants which depend on the nature of the adsorbent, the substances adsorbed and the solvent. From this equation it can easily be deduced that during the treatment of a certain solution with a certain quantity of adsorbent the degree of adsorption becomes greater as the size of the fractional quantities of adsorbent added decreases. This statement,

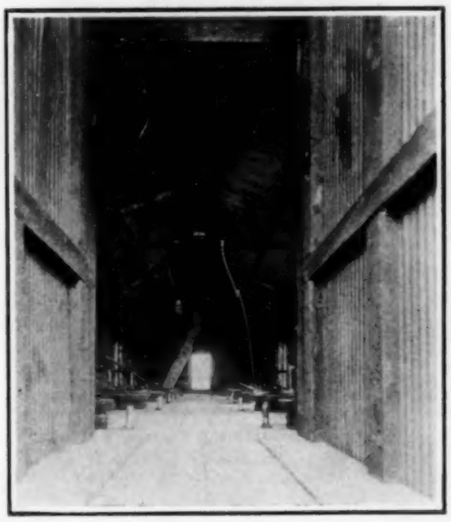


Fig. 1—Charging Oil Filters

Conveying fullers earth from revivifying kiln and showing method of feeding to the filters.

however, is based on the assumption that the solution is filtered free of powder before a fresh quantity of adsorbent is added, so that the filtration approaches in effect a very completely fractionated mixing. Therefore the effect of filtration on reversibly adsorbed substances must be greater than that of mixing with an equal amount of adsorbent, even if it is divided into several operations. The second condition which affects reversibly, as well as irreversibly, adsorbed substances is the fact that, whether the clay is used as a fine powder or in a coarse state, a certain amount of oil is taken up by the clay without changing the oil in any manner whatsoever; therefore, if a certain amount of adsorbent is added in fractions, the oil being filtered after each operation, each successive operation acts on a smaller quantity of oil. This results in an increased efficiency in the operation.

Refinery Procedures

The remarks in the foregoing paragraphs are particularly applicable to the decolorization of lubricating oils by adsorbents. A brief discussion of plant procedures in the purification of lubricants by the use of adsorbents is therefore considered as being within the limits of this article.

With the exception, perhaps, of some Pennsylvania oils, which are in many cases given no acid treatment but are filtered to color, the majority of the lubricating oils now being marketed are first given a chemical treatment, following such treatment with a clay treatment.

In the so-called "contact system," which involves the use of the material in a finely divided form, the adsorbent is usually allowed to act not only as a decolorizing agent but as a deacidifying agent as well. In such cases the processing of the oil is approximately as follows:

The oil after acid treatment in the agitators, but without being neutralized with caustic soda, soda ash or any other neutralizing agent, is pumped to the open top agitation tanks in the filter house. The oil is agitated, preferably by mechanical stirrers, since at the temperatures attained in this process air agitation would tend to oxidize the oil and thus throw "off-color" the product so acted upon, at the same time that it was being decolorized by the adsorbent.

The necessary amount of clay is then added to the oil in the tank, the quantity of clay used being dependent upon the nature of the oil and the extent to which the product is to be decolorized.

The agitation tank is suitably arranged for heating to temperatures varying from 250 to 350 deg. F. After all of the clay has been added to oil, agitation is continued, while at the same time the temperature is gradually raised to the point at which a maximum decolorizing and deacidifying efficiency is obtained from the adsorbent.

When the contact system of filtration is followed, the water in the clay proves to be very desirable for the following reasons:

1. The evolution of steam assists in agitating the clay and oil.

2. A layer of steam over the surface of the oil lessens the danger of oxidation.

3. As each particle of water is driven from the clay, the entrance of the impurities in the oil into the internal structure of the clay more readily becomes possible; in other words, the porosity of the clay seems to be increased.

The oil is held at the desired temperature until the evolution of steam has ceased, and then for approximately from 10 to 15 minutes additional time, continuing agitation. It is filtered while hot through filters to remove the suspended clay. The cloudy oil first coming from the filter press passes to tanks for such a product, these tanks being changed as soon as a clear oil results from the filtering operation. The clay not only will have adsorbed the free acid remaining in the oil as a result of the acid treatment but will have decolorized it to such an extent as to make a more readily marketable product.

When the oil is allowed to percolate through a column of coarse fullers earth, the clay acts chiefly as a decolorizing agent and as a remover of solid impurities, for in most cases the acid treatment has been followed by a neutralizing treatment. The clay, therefore, is not called upon to act as a deacidifying material.

Day ("Handbook of the Petroleum Industry," 1922), states that the size of the grain is of utmost importance in filtration; and that, in general, light oils require a less ignited and finer grain for filtration than do heavy viscous neutrals and steam-refined stocks. However, most refiners follow the practice of filtering steam-refined stocks in gasoline solution; those refiners that filter such viscous stocks without diluting have found a 16-30 mesh grade of fullers earth to give most satisfactory results.

Before being charged to the filters for use in the purification of petroleum products, the raw earth is "tempered" by drying in kilns of a suitable type to remove the hygroscopic moisture and water of crystallization. This "tempering process" increases the adsorptive value of the clay.

In filtering, refiners most frequently use a vertical type of filter, provided at the bottom with a blanket-covered perforated drainage plate to hold the clay, and equipped with manholes at the top and at one side near the bottom for charging and discharging the clay. The filters vary from 6 to 10 ft. in diameter and from 14 to 30 ft. in depth. The depth must be such that the clay and oil will be in contact for a sufficient length of time, but if the filters are made too deep (beyond 30 ft.) there is the increased danger of "channeling" to be considered.

Fig. 2—Revivifying Fullers Earth

After adsorptive value is exhausted the fullers earth is dropped from filter to screw conveyor shown at left and from these the bucket elevator carries it to revivifying kiln at right.

Filtration may take place either with gravity or pressure feed, although the latter method seems to be preferred by most refiners. After the filter has been charged with clay, the manhole at the top of the filter is closed, and the oil to be purified is pumped in at the top under a small pressure until the oil begins to "show through" the clay, after which the pressure may be somewhat increased. Filtration continues until the blended filtrate reaches the color standard previously established. After the fullers earth has adsorbed coloring matter and impurities to the limit of its capacity, the operation is stopped, the surplus oil washed out of the earth with steam and naphtha and the earth transferred by conveyors from the filter to kilns of a suitable type, where the earth is revivified by igniting at temperatures ranging from 1,000 to 1,400 deg. F. The illustrations in Figs. 1 and 2, obtained through the courtesy of the Dow Company, show modern methods of handling fullers earth in a petroleum refinery.

Recent investigational work by some refiners has shown that anti-gravity filtration—that is, pumping the oil up through the clay instead of allowing it to percolate downward—will give approximately 20 per cent greater efficiency from the clay. However, in such cases it is particularly necessary that the filters be strongly reinforced.

In this connection the data shown in Table I on the anti-gravity filtration of steam-refined lubricating stock that had been diluted with gasoline prior to filtration become of interest.

This table shows not only the temperature rise at the beginning of the reaction, indicative of a reaction of some sort, either chemical or otherwise; but it is also a further proof of the so-called "Day's phenomenon" that the filtration of petroleum through a finely porous medium not only results in the decolorization of the oil but also into a separation into fractions of various gravities, viscosities, and so forth.

Although refining by adsorption most frequently takes place in solution—that is, the treatment of the oil in the liquid phase—a few methods have been proposed for passing the vapors of the oil, during the process of distillation, through the adsorbing agent. Very interesting also are those methods that have been proposed for distilling the oil in the presence of the adsorbent. Neither general method, however, has been developed to such a point where it has become of great economical importance in the refining of petroleum products.

Table I—Anti-Gravity Filter Fractionation Data on "Cut-Back" Steam-Refined Lubricating Stock

Description	Original Stock	First Through Clay	Stream After 10 Bbl. Yield	Stream After 23 Bbl. Yield	Stream After 75 Bbl. Yield	Stream After 148.4 Bbl. Yield	Stream After 294.6 Bbl. Yield	Stream After 500.4 Bbl. Yield	Stream After 589.4 Bbl. Yield
Temperature of filter stream (deg. F.).......	......	106	136	118	106	84	68	68	68
Gravity..................	41.6	49.0	48.3	46.2	43.2	42.4	41.9	41.8	41.5
Sulphur (per cent).......	0.134	0.011	0.020	0.045	0.080	0.128	0.125	0.133	0.129
			After Reducing						
Gravity..................	23.0	30.7	29.7	27.7	25.4	23.9	24.1	22.9	23.3
Flash....................	430	460	480	440	420	435	470	440	440
Fire.....................	540	535	540	540	525	540	545	540	535
Vis. @ 100 deg...........	3,122	819	892	1,148	1,937	2,291	2,662	2,722	2,798
Vis. @ 210 deg...........	156	90	87	95	125	135	140	140	140
Pour.....................	60	55	55	55	65	65	65	65	65
Iodine value.............	18.0	0.61	1.2	4.3	12.1	14.8	16.4	17.4	18.1
A.S.T.M. carbon residue (per cent)............	2.25	0.008	0.027	0.115	0.546	0.932	1.49	1.61	1.79

Equipment News
From Maker and User

Four Wheel Drive Lift Truck

A new truck known as "Tec Uplift" has been put on the market by the Terminal Engineering Co., 17 West 44th St., New York. The most apparent difference between this truck and other elevating platform or lift trucks on the market is the absence of the small diameter pilot or trailer wheels, commonly used.

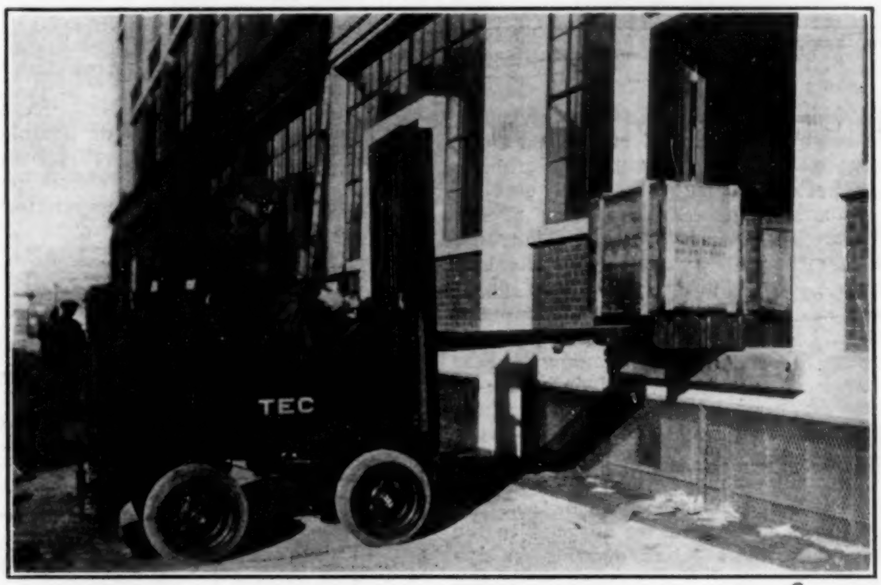
The elimination of these small wheels, it is claimed, permits more freedom of action for the truck in traversing obstructions, such as crossing Belgian block-paved streets, railroad crossings, etc. It is further claimed for this construction that the absence of the pilot or trailer structure permits the truck to approach closer to the freight car to the floor of which material is to be lifted or from which it is to be removed with the truck on the rail level. This claim also holds good in the matter of stacking goods in a warehouse awaiting shipment.

The truck is built with varying heights of uprights for different requirements. In some cases it is desired to have it run right into a freight car. In other cases high stacking is desired. In all cases the table, as shown in the photograph, will drop to a surface height of 5 in. from the floor. While loads may be carried directly on the platform, the manufacturer recommends the use of low leg wooden or all-steel demountable platforms or skids. In this way much time is saved, as the truck is not kept waiting for loading or unloading, but is used only for carrying.

The table is 4 ft. long by 26 in. wide. Provision has been made for changing the style of table by dropping out the platform and saddle with a horn, or double tang, or a vee type table. The horn type is intended for handling coiled rod or reels, car wheels, etc. The double tang type, the top of which goes down to within 2 in. of the floor, is intended for handling tin plate in loading into or unloading from freight cars, stacking in storage, etc. Other types of tables are available for handling tote boxes and a variety of work.

The capacity of separable bodies is 2,100 lb. evenly distributed load on 6 ft. platform, 2,300 lb. on 5 ft. platform, 2,600 lb. on 4 ft. platform, and 3,000 lb. on 3 ft. platform.

The hoist will raise a 3,000 lb. load at 25 ft. per minute. It will elevate empty at 50 ft. per minute. The hoisting unit is operated by an inclosed water-tight motor of the same type, rating and frame as those used in driving the truck. The reduction is through worm and gear, the worm and shaft being integral. A solenoid is used to release the brake on the motor shaft and an automatic brake is provided to prevent the load from being lowered too rapidly.



New Model Elevating Storage Battery Truck

The truck is carried on four wheels which have 20 in. x 5 in. solid rubber tires 3 in. thick. All four wheels are individually driven, each being provided with a standard vehicle motor, fully inclosed and weatherproof. There are three revolving members in the drive unit, consisting of motor shaft, reduction gear and pinion, which are integral, and the wheel itself. The entire unit is grease packed, requiring practically no attention for long periods, as reduction gear and wheel rotate on roller bearings and the motor has ball bearings.

Steering is accomplished by rear wheels only, which gives the shortest possible turning radius of 6 ft. 9 in. The rear wheels are equipped with full leaf springs and are each provided with internal expanding type brakes actuating inside the reduction gear member. Brakes are controlled by the operator's foot. An odometer is provided on one wheel to record mileage. The battery is placed over the rear wheels in a special compartment for the purpose, where it acts as counterbalance for the load and seat for the driver, the front wheels being the fulcrum. In addition to the counterbalancing effect of the battery, additional weight is attached at the rear of the truck in the form of plate. A coupling device is provided for use when it is desired to use the truck as a tractor.

Permanent Tank Material

Substance Now on the Market Which Withstands Most Acid and Other Corrosions

The Texas Gulf Sulphur Co., of 41 East 42nd St., New York City, has recently placed on the market a tank material which is used much as concrete would be and which has been named "Lavasul." It is a sulphur composition containing an inert form of carbon (coke) particularly adapted as a tank material. Both sulphur and carbon being chemically inert, a tank or container built of this material will withstand the action of practically all dilute acids, many concentrated, and other corrosive materials.

The melting point is about 235 deg. F., which is sufficiently high to permit of most chemical processes being carried on in containers of this material. On the other hand, this melting point may be taken advantage of in constructing a tank or vat by fusing the composition in an asphalt melter and running into appropriate forms. The operation is very similar to that used in ordinary concrete construction.

The carbon is in a very fine state of subdivision and therefore greatly increases the physical strength of the sulphur, which simply serves as a binding material. Since the specific gravity of the carbon is comparable to that of sulphur, the mixture is easily handled in a fused state and is readily poured and cast.

Lavasul weighs about 125 lb. to the cubic foot and may be reinforced with wire screen mesh or iron rods. Its tensile strength frequently amounts to

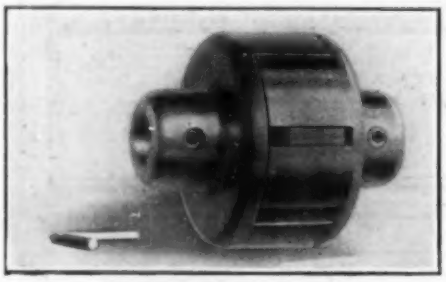


Fig. 1—Flexible Coupling for Fractional Horsepower Drives

1,000 lb. per sq.in. In the construction of large tanks, the use of crushed stone aggregate not only results in a stronger and better tank but lessens the cost.

It will withstand the action of hot ferric chloride solution, dilute muriatic acid, either hot or cold, hot dilute sulphuric, hydrofluoric, acetic and phosphoric acid, stannic chloride and many other troublesome and corrosive chemicals. About the only compounds that attack it are the few solvents of sulphur such as carbon bisulphide, gasoline, various oils and some of the caustic alkalis.

Lavasul is impervious, wet resistant and will not absorb dyes or coloring matter. It is therefore adapted to the construction of tanks or vats in dye works, chemical plants, steel mills and for chemical processes generally. It is an ideal material for the construction of muriatic acid storage or wherever it is desirable to have a leak-proof, corrosion-proof tank or container. Other uses are for electrolytic cells, forming tanks and storage battery charging table tops. Its very low heat conductivity permits economical maintenance of temperature.

Tanks of large size are now practically limited to wood or concrete. Where the wood itself is subject to attack, it is necessary to line the tank with sheet lead, which is expensive and is not permanent after the wood has deteriorated or decayed. When lead linings are not used, the contents of the tank are gradually absorbed by the wood and quickly corrode the tie rods or metal hoops. In other cases the wood becomes spongy and the tank develops leaks. Wood absorbs various dyes and colors which are hard to remove from the wooden vats used in the textile industry. Wood also gives rise to the formation of molds and injurious bacteria when used in various food processes and when in contact with fruit juices.

The makers of Lavasul contend that it removes these various difficulties and provides a tank of which the only competitors are glazed ceramic ware, glass and hard rubber.

Fig. 2—Flexible Coupling for Steam Turbine Drives

Flexible Couplings

Smith & Serrell, Newark, N. J., have added two additional types of flexible coupling to their already well-known line of "Francke" flexible couplings. These are shown in the accompanying cuts.

The coupling shown in Fig. 1 is for use with fractional horsepower drives. It is much simpler than the couplings for larger drives and has only three parts, two similar pressed steel flanges and a center spring cross. It is made

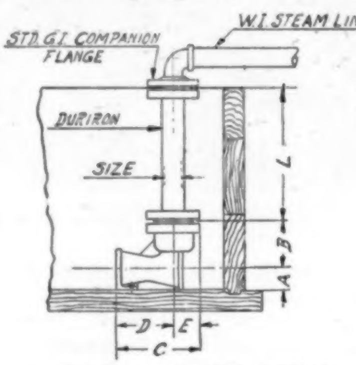


Fig. 3—Jet for Tank Opening

for shaft bores up to ¾ in., and is intended for motor drives from ¼ hp. to 1 hp. at 1,800 r.p.m. The spring cross is made of laminations of spring steel. It engages slots in the flanges and thus transmits the rotation flexibly.

In Fig. 2 is shown the new high-speed flexible coupling for steam turbine drives. It has two similar flanges which are fixed on the ends of the connected shafts. Between these flanges is interposed a flexible member, half of which is bolted to one flange and half to the other. The flexible feature is the usual "Francke" laminated spring. These flexible members are so designed that they have three direction flexibility. The coupling may be arranged for continuous lubrication or not as desired. Sizes are arranged with bores from 2 in. to 7¾ in. with speeds from 8,500 r.p.m. for the 2-in. size to 2,900 r.p.m. for the 7¾-in. size and horsepower from 6½ per 100 r.p.m. to 98 in the same order.

Handy Bench Machine

Plants where many crates or boxes must be made incidentally to the regular course of manufacture will be interested in a new electrically driven bench woodworking machine recently placed on the market by the DeWalt Manufacturing Co., Leola, Lancaster, Pa. This machine will do cross-cutting,

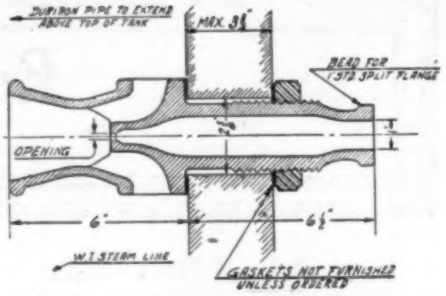


Fig. 4—Jet for Riser Connection

ripping, mitering, beveling, matching, molding, shaping, sanding, boring, turning and other such operations. Its power requirements are small and it is designed to cut material 2 in. thick and 15 in. wide and any desired length.

Steam Jet for Acid Baths

The Duriron Co., Dayton, Ohio, has placed on the market a steam jet of the ejector type for use in heating acid baths with live steam. The ejector principle is used, because it is claimed that it creates a good circulation in the bath and also eliminates any destructive pounding or hammer. The liquid that is being heated is mixed by this device in a most thorough manner with the steam and an even temperature is thus obtained throughout the bath.

Two different types of this jet are made. One of these enters through the side of the tank and the other is designed to be connected to the steam line by means of a Duriron riser passing through the liquid in the tank. The first of these types is shown in Fig. 3 and the second in Fig. 4. The jets are made with steam openings from ¼ to ¾ in. in 1/16-in. steps for connection to 1-in. and 1¼-in. lines. In addition to this equipment being acid resistant, it is claimed that its permanence is great, for the metal is so hard that the steam has little effect in wearing it.

Catalogs Received

ESTERLINE-ANGUS Co., Indianapolis, Ind. —Bulletin 124. A bulletin announcing the new "Model LR" graphic meter. This is a new meter designed to replace the familiar "Model MS" meter which has been marketed by this firm for a number of years.

DEWALT MFG. Co., Leola, Lancaster, Pa. —A folder describing the "Dew-All," a bench machine that can be used as a saw, a tenoner, a grinder, a shaper, a lathe and for various other purposes.

COMBUSTION ENGINEERING CORPORATION, New York City—Bulletin AH-1. This is a pamphlet describing the new C.E.C. air-heater, which is a plate type of heater used to recover a portion of the waste heat in the flue gases for preheating the combustion air of furnaces.

DRIVER-HARRIS Co., Harrison, N. J.—Catalog R-24. A catalog entitled "Alloys for Electrical Resistance." This is a book describing Nichrome and other alloys which this company makes. It contains many valuable tables of the electrical resistance of various types of alloys.

FOXBORO Co., INC., Foxboro, Mass.—Bulletin 96-1. The second general catalog of the Foxboro Co. describing the various types of indicating, recording and controlling instruments made by this firm.

LINK-BELT Co., Chicago, Ill.—Book 660. A catalog describing chains and conveying equipment for pulp and paper mills, woodworking plants and sawmills.

Review of Recent Patents

Activated Carbon

Process for Building Up a Carbon Structure With Maximum Effective Pore Spare

The best type of adsorbent charcoals are those that are most free from hydrocarbon impurities, possess a large degree of porosity (with pores of the continuous or spongy type) and have supporting walls that are most dense. With these points in mind, Jacque C. Morrell has developed a process that is described in Patents 1,478,985 to 1,478,987 inclusive, granted Dec. 25, 1923. The process may be illustrated by the following outline, taken from Patent 1,478,985, covering the production of a synthetic charcoal from carbon black.

The carbon black is first cleansed of its volatile oily impurities by a steam treatment at a temperature of 450 to 600 deg. C. for several hours. As a binding agent, an emulsion of soft pitch is used, made from a mixture of a suspension of hard pitch in water containing a protective colloid such as ammonium tannate-tannic acid and an emulsion of anthracene oil, emulsified in a solution containing a small percentage of ammonium tannate-tannic acid mixture (or other protecting colloid). The addition of the carbon black to the emulsion presents some difficulty, caused by the fact that the carbon black is extremely light and adsorbed air still further tends to buoy up the material. The usual method of mixing is to add the carbon black in a steady stream to the emulsion, meanwhile agitating vigorously. The mixture is then filtered to remove most of the water and dried at a temperature of 85 to 140 deg. C.

The mixture freed from water is placed in a mold consisting of a sleeve, plunger and plug, which is heated to about 90 deg. C. and compressed with a pressure of from 16 to 30 tons per sq.in. The function of molding under pressure is a very important one, determining to a large extent the nature and quality of the finished product. The crude charcoal from the press is crushed and ground to from 8 to 10 mesh or any desired size. The ground material is introduced into a furnace and gradually brought to the decomposing temperature at which the binder chars. For activation, schedules of 4 hours at 850 deg. C., then to 925 deg. C. for half an hour, and of 3 hours at 925 to 950 deg. C. have proved satisfactory.

A final heat-treatment following the above steps causes a marked improvement in the efficiency of the charcoal. This is true not only of synthetic charcoals but also of other charcoals, as for instance standard coconut charcoal, which showed an improvement of 50 per cent in activity after this treatment. The apparent density of the charcoal after this treatment shows a pronounced lowering, which, it is thought, is caused by the internal oxidation by adsorbed air or the removal of hydrocarbons or both, by this heat-treatment. Heating beyond a certain length of time in the first carbonization treatment causes little improvement in the charcoal. However, if the charcoal is allowed to cool to about 250 deg. C. removed from the furnace and cooled in the air to room temperature to prevent the adsorption of hydrocarbons by the charcoal upon a second heat-treatment, the above-described results take place. Since the walls of the furnace contain condensed hydrocarbons, the second heating is done in a different furnace (though if cleansed one furnace will suffice). The conditions under which this heat-treating process is carried on should be at 850 to 950 deg. C. for about 2 hours.

The Use of Enriched Air in Metallurgical Furnaces

Excess Power From Waste-Heat Boilers Sufficient to Produce Oxygen for Enrichment

Although much attention has been given recently to the question of increasing the efficiency of metallurgical furnaces through the use of oxygen, or enriched air, it has been held quite generally that such a step depended upon the production of cheap oxygen. Edward Weymann, of Dortmund, Germany, makes the interesting suggestion that by the use of enriched air in furnaces without recuperators the products of combustion leave the furnace at a high enough temperature to generate in waste-heat boilers more than enough power to supply the oxygen required for enrichment. This statement is backed up by figures in Patent 1,479,347, granted Jan. 1, 1924, and assigned to Eisen- und Stahlwerk Hoesch Aktiengesellschaft, of Dortmund, Germany.

In the case of a 100-ton open-hearth furnace burning 106,000 cu.ft. of coke-oven gas per hour, it is possible to recover 4,700 lb. of steam at 140 lb. per sq.in. superheated to 570 deg. F., by means of waste-heat boilers placed behind the preheating chambers and the change valve. If the recuperators are eliminated, 124,000 cu.ft. of gas enriched with 24,700 cu.ft. of oxygen is required to operate the furnace, but it is now possible to recover 19,700 lb. of steam at 140 lb. and 570 deg. F. because of the higher temperature of the waste gases reaching the boiler. In order to get this figure on the same basis as the original 106,000 cu.ft., an allowance of 5,000 lb. of steam is made for the additional 18,000 cu.ft. of gas burned without the recuperators. In other words, 106,000 cu.ft. of gas will give 14,700 lb. of steam without recuperation and only 4,700 lb. with recuperation, or a balance of 10,000 lb. in favor of the former method.

Now a modern oxygen-producing device such as the Claude type liquefaction machine requires 0.034 hp. per cu.ft. of oxygen. A modern steam turbine plant will produce 1 hp.-hr. from 9.92 lb. of steam at 140 lb. per sq.in., superheated to 570 deg. F. so that the production of 24,700 cu.ft. of pure oxygen for enriching the air will require $24{,}700 \times 0.034 \times 9.92 = 8{,}300$ lb. of steam. As 10,000 lb. is available, it is evident that the excess power obtained from the waste-heat boilers by using enriched air without recuperation is more than sufficient to produce the oxygen required for enrichment.

Utilizing Bagasse Fibers

Treatment With Lime Before Baling Prevents Deterioration of Bagasse Fibers to Be Used for Pulp

One of the many problems that had to be met in attempting to prepare heat-insulating lumber from bagasse is discussed by Treadway B. Munroe, of Chicago, Ill., in Patent 1,479,419, granted Jan. 1, 1924, and assigned to C. F. Dahlberg, of Minneapolis, Minn.

Bagasse fibers as they leave the mill contain considerable quantities of sugar and gummy matters, and as masses of these fibers are usually left out in the weather in hot climates for considerable periods of time, alcoholic and acetic acid fermentations soon set in, which go on at the expense of these constituents. After the acetic acid fermentation a continued exposure to the weather will cause what may be termed a humic acid fermentation or deterioration, which destroys the strength of the fiber.

It is therefore very desirable to prevent these deteriorating actions, before the fibers are cooked, preparatory to making them into the desired heat-insulating boards.

This may be accomplished by placing on the interior of a mass of bagasse fibers a substance that will not only prevent the above-mentioned fermentations but will react with the liquid constituents present in the bagasse mass to generate sufficient heat partly to cook the mass while preserving it. Such a substance may be caustic lime, or CaO in the dry state. This calcium oxide is conveniently sprinkled on the bagasse while spread out, and the mass is then passed into a baling press, subjected to pressure and bound into bales.

Any fermentation that may occur in those portions not reached by the caustic lime will give rise to heat and a liquid, and in those portions of the mass occupied by said lime, the latter will be hydrated by the liquid present. This will give rise to more heat on the interior of the mass. The baling action will form substantially air- and liquid-proof layers of compacted fibers on the exterior of the bale through which very little air will enter to the

interior and very little heat will escape to the exterior.

The result is a semi-cooking solution on the interior of the mass which is held therein by the exterior layers, the fibers of which are cemented together by the sugar and gummy matters present. When the bale is opened preparatory to subjecting its fibers to the regular cooking action before forming them into a finished board, these baled fibers are found to possess not only their full strength free from all deteriorating influences but to be in a partly cooked or softened state, so that the normal cooking thereof is greatly facilitated or even obviated.

Book Reviews

Stoughton's "Metallurgy" in a Rewritten New Edition

THE METALLURGY OF IRON AND STEEL. By *Bradley Stoughton.* A new post-war edition, rewritten and enlarged, 519 pages. McGraw-Hill Book Co. Price, $4.

Most steel metallurgists were raised on "the metallurgist's bible," by Stoughton, and hardly one of them would deny that every steel man should own it. And the man who has felt that he ought to learn something about steel has found that he could do no better than to rely on the same book. It is therefore probably as well known as any similar technical publication. Now comes a new edition written in the light of the remarkable progress in this field in the past 10 years. Taking the reviewer's word for it that the subject is covered fully as well as in the earlier editions and recalling the advancements in the steel industry in the last decade, it is to be seen that this is really a new book.

Stoughton's ability as an engineer is so well known as to need no comment, but it is worthy of note that he has that happy faculty, unfortunately very rare among scientific authorities, of being able to express himself not only clearly and simply but also readably. An authoritative work amply covering such a field as the metallurgy of iron and steel in one volume in such a way as to be interesting reading could be produced by few others.

It would take pages to point out the thoroughness with which he covers the many processes by which iron is extracted from its ores and adapted to its multitudinous niches in the industrial world. This is typified by a few paragraphs in the chapter on the manufacture of pig iron, in which are given directions for calculating a blast-furnace charge. Such information is of prime importance to the young steel metallurgist, because the ability to calculate a charge is sometimes a cause for advancement, and the knowledge of the way to do it is not always obtainable from his superior. The book is full of such fragments of bread-and-butter information and at the same time it maintains that perspective so pleasing to the engineer who does not work with steel but is reading the book to broaden his general knowledge.

CLIFFORD B. BELLIS.

Books Received

Ethyl Chloride for Refrigeration

THE THERMAL PROPERTIES OF ETHYL CHLORIDE. By *C. F. Jenkin* and *D. N. Shorthose.* Special Report No. 14 of the British Food Investigation Board. 36 pages. Available from His Majesty's Stationery Office, Imperial House, Kingsway, W. C. 2, London. Price, 1s. 6d. net.

The object of the research reported in this document was the determination of the thermal properties of ethyl

American Patents Issued January 8 and 15, 1924

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests, and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,479,782—Pump. Elbert W. Barton, Binghamton, N. Y.

1,479,784—Thermostatic Control Device. Cyrus M. Bosworth, Lakewood, and Aloysius G. Boesel, Cleveland Heights, Ohio.

1,479,790 — Evaporation - Preventing Mantle. Alex B. Davis, Cincinnati, Ohio, assignor of one-half to George Chamberlain, Decatur, Ill.

1,479,822—Manufacture of Coal or Other Briquets. Henry Gardiner Lloyd, Surbiton, England, assignor of one-half to George St. Barbe, London, England.

1,479,827—Retort Furnace. Charles V. McIntire, East Orange, N. J.

1,479,833—Method for Refining Oils. William J. Reilly, Denver, Colo.

1,479,851—Decolorizing Carbon and Method of Making Same. Rod A. Demme, New York, N. Y., assignor to Darco Corporation, New York.

1,479,852—Process for Treating and Purifying Gases Containing Hydrogen Sulphide. Alfred Engelhardt, Wiesdorf, Prussia, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen, near Cologne-on-the-Rhine, Germany.

1,479,859—Process for Making Antifriction Metal. William Koehler, Cleveland, Ohio.

1,479,874 — Process of Hydrolyzing Nitriles. Gilbert E. Seil, Oakmont, Pa., assignor to Roessler & Hasslacher Chemical Co., New York.

1,479,875—Refuse Incinerator. Bernard F. Shaughnessy, Brooklyn, N. Y.

1,479,904—Compound Gyratory Screening Device. Henry William Falker, Ashland, Pa.

1,479,955—Cellulose-Ether Solvent and Composition. Stewart J. Carroll, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester.

1,479,982—Method of Making Anhydrous Magnesium Chloride. William R. Collings and John A. Gann, Midland, Mich., assignors to Dow Chemical Co., Midland, Mich.

1,479,998—Method of and Apparatus for Treating Filtering Materials. John Robert McConnell, Warren, Pa.

1,480,016—Cellulose Solvent and Resulting Cellulosic Composition. Max Y. Seaton, Midland, Mich., assignor to Dow Chemical Co., Midland, Mich.

1,480,045—Apparatus for Treating Hydrocarbon-Containing Materials. Clifford P. Bowie, Berkeley, Calif., and Martin J. Gavin, Boulder, Colo.

1,480,063—Conveyor in Glass-Making Apparatus. Clarence I. Hall and Alexander Samuelson, Terre Haute, Ind., assignors to Chapman J. Root, Terre Haute.

1,480,117—Method of Compressing Gas and Apparatus Therefor. Edward A. Rix, San Francisco, Calif.

1,480,148—Gas Producer. Ernest L. Broome, Tarrytown, N. Y., assignor to General Reduction, Gas & By-Products Co., New York, N. Y.

1,480,152—Gas Producer. Abraham B. Cox, Cherry Valley, N. Y., assignor to General Reduction, Gas & By-Products Co., New York, N. Y.

1,480,160. Coke-Oven-Clearing Mechanism. David Ferguson, Pittsburgh, Pa.

1,480,166—Manufacture of Hydrazine. Reginald Arthur Joyner, Stevenston, Scotland, assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.

1,480,183—Gas Producer for Use With Automotive Mechanisms. William W. Odell, Washington, D. C.

1,480,230—Process of Carburizing Steel and Iron. Toyokichiro Tashiro, Tokyo, Japan.

1,480,251—Process and Apparatus for Hydrogenation. Carleton Ellis, Montclair, N. J.

1,480,267—Process for the Manufacture of Manganese or of Manganese Alloys Poor in Carbon and Silicon. Bo Michäel Sture Kalling and Sven Dagobert Daniell, Trollhattan, Sweden, assignors to Aktiebolaget Ferrolegeringar, Stockholm, Sweden.

1,480,271—Installation for Degasifying Noncoking, Bituminous Materials at Low Temperature. Heinrich Koppers, Essen-Ruhr, Germany.

1,480,291—Process for Obtaining Nitrogen From the Air. Wilbur Armistead Nelson, Nashville, Tenn.

1,480,315—Magnetic Separator. Herbert Huband Thompson, Birmingham, and Alfred Evan Davies, Tanworth-in-Arden, England.

1,480,319 — Rotary Cement - Burning Kiln. Mikael Vogel-Jörgensen and Kristian Middelboe, Frederiksberg, near Copenhagen, Denmark, assignors to F. L. Smidth & Co., New York, N. Y.

1,480,361—Furnace. Frank M. Allen, Claymont, Del., assignor to General Chemical Co., New York, N. Y.

1,480,379—Settling Tank. Roy D. Elliott and Otto J. Jacobson, Crockett, Calif.

1,480,382—Method of Crystallizing Fluids. Crosby Field, Yonkers, N. Y.

1,480,418—Material for Carburizing. George W. Pressell, Philadelphia, Pa., assignor to E. F. Houghton & Co., Philadelphia.

1,480,425 — Pumping Apparatus for Viscous Liquids. Charles Fred Topham, Coventry, England, assignor to Courtaulds Limited, London, England.

1,480,500—Save-All. George Wilbur Brown, Millwood, Wash., assignor to Inland Empire Paper Co., Millwood, Wash.

1,480,542—Process of Polishing Glass. Christopher Brown, Charleroi, Pa., assignor to Pittsburgh Plate Glass Co.

1,480,625—Apparatus for Drawing Sheet Glass. Robert A. Miller, Creighton, Pa., assignor to Pittsburgh Plate Glass Co.

1,480,640—Manufacture of Chromium Compounds of Azo Dyestuffs. Fritz Straub and Richard Sallmann, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

PRODUCTION OF IRON IN THE BLAST FURNACE. *P. H. Royster, T. L. Joseph,* and *S. P. Kinney.* A description of an investigation of blast-furnace operating conditions at the Minneapolis Experiment Station of the Bureau of Mines. *The Blast Furnace & Steel Plant.* January, 1924, pp. 35-37.

A MECHANICAL MODEL FOR ALLOYS. *M. M. Austin.* A mechanical analogy to the hardening effect of small grain size and other causes of hardness in metals. *Chemical Bulletin,* January, 1924, p. 12.

RAW-MATERIAL REVIEWS FOR 1923. ARSENIC. *H. M. Brush,* p. 92; PHOSPHATE ROCK, *H. D. Ruhm,* p. 93; FLUORSPAR, *G. H. Jones,* p. 93; TALC, *Raymond B. Ladoo,* p. 94; QUICKSILVER, *H. W. Gould,* p. 95; GRAPHITE, *B. L. Miller,* p. 95; NITRATE, *Huntington Adams,* p. 96; FELDSPAR, *C. H. Cook,* p. 97; SULPHUR AND PYRITES, *Raymond F. Bacon,* p. 97; *Eng. & Mining Journal-Press Review Number and Year Book,* Jan. 19, 1924.

TECHNICAL DEVELOPMENTS. PYROMETALLURGY. *E. H. Robie,* p. 109; METALLURGY OF IRON AND STEEL, *Bradley Stoughton,* p. 112; *Eng. & Mining Journal-Press. Review Number and Year Book,* Jan. 19, 1924.

NAPHTHALENE: ITS DEPOSITION FROM COAL GAS. *W. I. Ineson.* A discussion of the extent and means for prevention of this operating difficulty. *Gas Journal,* Dec. 26, p. 835.

NOTES ON MODERN CARBONIZATION IN CONTINUOUS VERTICAL RETORTS. *A. Y. Plant.* Presents operating test data on Drakes' continuous vertical retorts at the Halifax gas works. *Gas Journal,* Dec. 26, p. 838.

chloride that are significant in use of the material for refrigeration purposes. The data reported include latent heat, total heat of liquid, total heat of vapor, throttle experiments, density, compressibility and dilatation of liquid, vapor pressures and solubility of water and air in ethyl chloride. The great importance attached to use of this material as a commercial refrigerating liquid will add unusual interest to this report.

Calcium Arsenate

ARSENIC, CALCIUM ARSENATE AND THE BOLL WEEVIL. Being a compilation of articles and addresses by *Howard W. Ambruster.* 42 pages, illustrated. Barr-Erhardt Press, Inc., New York. Price 50 cents.

Mr. Ambruster was one of the first to grasp the great economic and technical significance of the boll-weevil problem. His early articles on this subject represent pioneer technology in a field of chemical engineering that is only at the beginning of its development. A marked service has been performed by bringing together the various articles from Mr. Ambruster's pen and publishing them in chronological order in this attractive pamphlet.

British Department of Scientific and Industrial Research

REPORT OF THE COMMITTEE OF THE PRIVY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH FOR THE YEAR 1922-1923. 141 pages. His Majesty's Stationery Office, London. Price, 4s. net.

This report for the year ended July 31, 1923, contains an account of the work that has been done and is in progress by the research boards and committees of the department. These include the National Physical Laboratory; Geological Survey Board; Food Investigation Board; Research Boards for Fuel, Forest Products, Building, Physics, Chemistry, Engineering and Radio; Research Committees for Fabrics, Adhesives, Oxygen, Gas Cylinders, Lubrication and Current Meters. Developments in the organization of research in India, Egypt and the overseas dominions and an outline of the new state research organization in France are included in the appendices.

Colloids

COLLOID SYMPOSIUM MONOGRAPH. Papers and discussions presented at the First National Symposium on Colloid Chemistry, University of Wisconsin, June, 1923. Edited by *J. Howard Mathews,* director of the course in chemistry. 419 pages, illustrated. University Co-operative Co., Madison, Wis. Price, $2.75.

With the exception of three papers, one already published and two to be published elsewhere, this is a complete report of the papers and discussions which made up the First National Symposium on Colloid Chemistry, held in Madison, Wis., June 12 to 15, 1923, under the auspices of the University of Wisconsin. The twenty-two papers cover a wide range of colloid work and constitute a most valuable addition to the literature of colloid chemistry.

FIFTH REPORT ON COLLOID CHEMISTRY AND ITS GENERAL AND INDUSTRIAL APPLICATIONS. (With index to the five reports.) 130 pages. H. M. Stationery Office, London. Price, 2s. 6d. net.

Six papers have been contributed to this final report: Measurement of Surface Tension, by Allan Ferguson; Collagen and Gelatine, by H. R. Procter and John Arthur Wilson; Colloid Phenomena in Bacteriology, by Erick Rideal; Industrial Applications of Wetting Power, by W. H. Nattall; Colloids in Relation to Manufacture of Inks, by C. A. Mitchell; Manufacture of Artificial Silk in Relation to Colloid Chemistry, by Edward Wheeler. In addition there is a general index to the five reports which form the series. The four earlier reports were published in 1917, 1919, 1920 and 1922, the first three being available at 2s. 6d. each, while the price of the fourth is 5s. 6d.

Pulp and Paper Making

MANUFACTURE OF PULP AND PAPER. VOL. IV. PAPER MAKING. Prepared under the direction of the joint executive committee on vocational education representing the pulp and paper industry of the United States and Canada. 527 pages, with numerous illustrations. McGraw-Hill Book Co., New York. Price, $5.

The fourth of a series of texts, written to serve students and operating men in the pulp and paper industries. The various sections in the present volume deal with the manufacture of paper. Each phase from rag preparation to paper machine design and control is written by an outstanding expert. The first text of its kind to be published in the United States and one worthy of recognition as a standard in its field.

Men in the Profession

GEORGE A. BARCLAY has been appointed general mill superintendent of the Bethlehem Steel Co., succeeding HARRY J. KELLY, who recently resigned to take a position with the Empire Steel enterprises in Canada. WILLARD H. BURGARD, former foreman of the rail mill, will become rail mill superintendent, succeeding Mr. Barclay.

Dr. H. E. BARNARD, director of the American Institute of Baking of Chicago, addressed the Southern California Section of the American Chemical Society, Los Angeles, Jan. 18, on "The Application of Science in the Baking Industry." He also spoke before the Syracuse Section on Jan. 8, on "The Chemistry of Baking."

GEORGE H. BUNKER, treasurer of the Guantanamo Sugar Co., New York, has been elected vice-president, in addition to his present office. JOHN WOLLPERT has been elected assistant treasurer.

W. F. CALDWELL has completed his engagement as mechanical engineer for the Champion Fibre Co. (pulp and paper manufacturer), Canton, N. C. He is now with the Grasselli Chemical Co. as chief engineer of its dyestuff plant at Albany, N. Y.

WILLIAM MANSFIELD CLARK delivered a presidential address entitled "Life Without Oxygen" before the Chemical Society of Washington, on Jan. 10.

DONALD F. CRANOR has joined Binney & Smith, 41 East 42nd St., New York, makers of the reinforcing pigment Micronex, as director of development, which will include responsibility for technical service to users of Micronex. Mr. Cranor for the past 11 years has been chief chemist and assistant super-

intendent of the Lee Tire & Rubber Co., Conshohocken, Pa.

JOSEPH B. DEISHER, for 14 years connected with the T. H. Symington Co. at Rochester, N. Y., has resigned his position as assistant superintendent, effective Feb. 1, to succeed the late Mr. Beckett, of the American Malleable Castings Association, as field representative, attached to the consulting engineer's office at Albany, N. Y.

R. A. DITTMAR, assistant manager of the Atlas Portland Cement Co.'s plant at Hannibal, Mo., has been made acting manager of the plant of this company at Hudson, N. Y.

Dr. WILLIS E. EVERETTE, consulting technologist of San Rafael, Calif., has returned from a 2-year trip of exploration through Egypt and Europe.

Dr. MARIE FARNSWORTH, formerly at Iowa State College, Ames, Iowa, is now at the Nonmetallic Minerals Station, Bureau of Mines, New Brunswick, N. J.

F. A. J. FITZGERALD, who sailed for Europe Dec. 15, is expected back about the middle of February.

E. C. FREELAND, recently elected head of the department of sugar technology, Agricultural College of Trinidad, B. W. I., has resigned owing to ill health, and will return to the United States. He will become connected with Penick & Ford as superintendent of their sugar refinery at Marrero, La.

JOHN FUCHS, chief sugar chemist, Lower Lafourche Refinery, Lockport, La., has resigned to become assistant superintendent of the Cuatotolapam Sugar Co., Cuatotolapam, Vera Cruz, Mexico.

Dr. H. W. GILLETT has been appointed chief metallurgist of the Bureau of Standards, to succeed G. K. BURGESS, who recently was promoted to the directorship. Dr. Gillett for a number of years has been engaged in work on alloys at the Ithaca section of the Bureau of Mines.

DONALD GRENFELL has been transferred from the Palmerton plant of the New Jersey Zinc Co. to the new lithopone plant of the Mineral Point Zinc Co. at Depue, Ill., which is nearing completion.

Dr. HARRY N. HOLMES, professor of chemistry in Oberlin College, Ohio, on Jan. 9, 10 and 11, at Carnegie Institute of Technology, Pittsburgh, Pa., delivered a series of lectures on colloids, emulsions and gels.

Dr. DAVID WILBUR HORN, professor of physics and physical chemistry, Philadelphia College of Pharmacy, Philadelphia, Pa., gave an address in the lecture room at the institution, Jan. 10, on the subject of "Radiations."

D. C. JACKLING, of New York, head of the Kennecott Copper Co. and prominently identified with other copper and metal interests, has left for a trip to South America, primarily to inspect the Braden mines of the company.

A. A. LANDON, vice-president and assistant to the president of the American Radiator Co., resigned on Jan. 1. He became associated with the company as superintendent of the Kalamazoo plant in 1895, was later superintendent of the Titusville plant. He went to the Pierce plant in Buffalo several years ago as general manager of manufacturing, and later was made vice-president and director. Mr. Landon will, however, serve as counsel to the executive committee in the States, as well as to the advisory board in Paris, France, where he will spend a part of his time.

A. IRVING MCLAUGHLIN, assistant treasurer, Carpenter-Morton Co., Boston, Mass., manufacturer of paints, etc., has been elected vice-president. He has been connected with the company for 39 years.

C. B. MERSHON is now employed by the Northern Indiana Gas & Electric Co. as an industrial gas sales engineer.

A. V. H. MORY has resigned as director of the technical bureau of the Biscuit and Cracker Manufacturers' Association of Chicago, and has joined the staff of the Bakelite Corporation, with headquarters in New York City. He will have charge of technical and scientific publicity, acting as liaison officer between the Bakelite Corporation and the chemical profession and industry.

H. C. PARMELEE has been elected an associate member of the Alpha (Columbia University) Chapter of Epsilon Chi, honorary electrochemical society. On Jan. 17 he addressed the chapter on the subject "Some Pioneers in Electrochemistry."

J. G. PEAKE, a research chemist of the Dixson Research Laboratory, Sydney University, Australia, is in the United States, investigating chemical engineering methods and equipment. Mr. Peake has been in Washington for some time and is now in New York.

FRANK A. SEIBERLING, head of the Seiberling Rubber Co., Barberton, Ohio, and formerly president of the Goodyear Tire & Rubber Co., gave an interesting address on present business conditions and future prospects before a joint meeting of the Exchange and Optimists Club, Portage Hotel, Akron, Ohio, on Jan. 9.

Prof. J. B. SHAW, department of ceramics, Alfred University, Alfred, N. Y., has resigned to become head of the new department of ceramic engineering established at the Pennsylvania State College, State College, Pa.

AUGUST STAUDT, head of the Perth Amboy Tile Works, Perth Amboy, N. J., has been elected president of the local Lions' Club for the ensuing year.

J. C. WITT is now with the Victor Chemical Works, Chicago, Ill.

Calendar

AMERICAN CERAMIC SOCIETY, Atlantic City, N. J., Feb. 4 to 9.

AMERICAN CHEMICAL SOCIETY, annual meeting. Washington, April 21 to 25.

AMERICAN CHEMICAL SOCIETY, annual sectional meeting, Syracuse, N. Y., Feb. 1 and 2.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 25 to 28.

AMERICAN ELECTROCHEMICAL SOCIETY, Hotel Bellevue-Stratford, Philadelphia, April 24 to 26.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, New York City, Feb. 18 to 21.

AMERICAN PHYSICAL SOCIETY, New York, Feb. 23.

AMERICAN SOCIETY FOR STEEL TREATING, winter sectional meeting, Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1.

CANADIAN NATIONAL CLAY PRODUCTS ASSOCIATION, Prince George Hotel, Toronto, Ont., Feb. 13 and 14.

COMMON BRICK MANUFACTURERS' ASSOCIATION, Biltmore Hotel, Los Angeles, Calif., Feb. 11 to 14.

PAPER INDUSTRIES EXPOSITION, New York, April 7 to 12.

Obituary

WILLIARD A. DEANE died at Nichols, Fla., on Dec. 26, at the age of 44. Mr. Deane took a special course in metallurgy at Lehigh under Dr. Richards. He was graduated from the Michigan College of Mines. From 1905 to 1916 he held positions of responsibility at different operations in Mexico, the United States and Canada. Since 1916 he had been mainly engaged in research work. He was for 3 years in the research department of the Dorr Co., following which he held the position of director of research, first with the Hardinge Co. and afterward with the Phosphate Mining Co., being with this company at the time of his death. He was a member of the American Institute of Mining and Metallurgical Engineers and the American Chemical Society, and was the author of several articles on chemical research.

FRANK W. GITHENS, chemist at the du Pont company's dynamite plant at Ashburn, Mo., died following an operation at Hannibal, Mo., on Jan. 12. Mr. Githens was a graduate of Swarthmore and had been with the du Pont company since leaving school.

WILLIAM HOOPES, one of the pioneers in developing, with Charles M. Hall, the aluminum industry as we know it today, died Jan. 9. Mr. Hoopes was an inventive genius of the highest order and the aluminum industry is deeply indebted to his fertile mind and ceaseless activity for many of its technical successes. He was actively interested in the research and technical problems of the Aluminum Co. of America at the time of his death. He was born in West Chester, Pa., July 20, 1867. He was associated with the Aluminum Co. of America since 1900.

OTTO J. LAIST, a prominent chemist and glycerine expert, died at his home at Oakland, Calif., Jan. 1, at the age of 89 years. He was a native of Germany and graduate of Leipzic University, coming to the United States when a young man. He is said to have discovered a new process for refining glycerine, and installed the glycerine refinery at Pinole, Calif., for the California Powder Works. He had resided at Oakland since 1890, and is survived by his wife and five sons.

News of the Industry

Summary of the Week

Muscle Shoals offer made by Union Carbide Co. offering $150,000 per year for Nitrate Plant No. 2 and the Waco Quarry.

Federated American Engineering Societies changes name to American Engineering Council.

Joint meeting of Engineering Section of National Safety Council and American Society of Safety Engineers develops many precautions economically feasible.

Cause of Corn Products plant explosion at Pekin, Ill., found to be in bearing which overheated and ignited starch dust.

Legislation to prevent oil pollution of coastal waters considered likely at Washington.

Chemical manufacturers develop new compound which offers much promise as boll-weevil control.

Calcium arsenate buying slowed up because of publicity given to possible tariff changes.

Treasury Department announces that regularly established associations may examine manifest to secure import data.

German fertilizer interests cut down demands for potash and production of the latter is affected.

Union Carbide Makes Muscle Shoals Offer

Would Give $150,000 Per Year for Use of Nitrate Plant No. 2 and of Waco Quarry—Military Affairs Committee at Work

DISCUSSION of the various offers for the government's Muscle Shoals properties before the Military Affairs Committee of the House of Representatives has had the effect of bringing these offers to a comparable basis. The committee now has before it information which will permit it to negotiate. The sentiment on the committee in favor of the Ford offer, however, is so strong that there is determined opposition to the appointment of a joint negotiating committee and it is not unlikely that the committee will report favorably upon the Ford offer without taking advantage of the unusual opportunity it has to make a better deal with the interests that have submitted offers.

The Union Carbide Offer

The Union Carbide Co. submitted its offer Wednesday. It was accompanied by a letter which reads as follows:

"Our business is a large and diversified one and there are more or less regular demands for increasing amounts of hydro-electric power. Our products are produced on the tonnage basis and sold at moderate prices, and hence a large plant operation or unit is required for economical manufacturing. We are always, however, confronted with difficulty upon the question of distribution, and this has been emphasized since the higher railway freights have been effective. No one of our products could be manufactured at Muscle Shoals or elsewhere in the South upon a scale large enough to permit of economical manufacture and distribution, but owing to the number of our products and the diversity of our markets, we are able to work out a plan of producing there and distributing several of our existing products, including the manufacture in a substantial way of a new product not now being commercially manufactured in this country.

"On the other hand, at points where our existing plants are located, we either own power developments or have under contracts, some of which run for many years, substantial blocks of hydro-electric power. Some of these contracts are more or less elastic and in the aggregate they contain provisions which would permit, if we so choose, our relinquishing, either temporarily or permanently, between 40,000 and 50,000 hydro-electric horsepower. Furthermore, we have had in contemplation the construction of a large hydro-electric power plant at a site owned by an associated company, which undoubtedly could be developed in an amount much larger than that contemplated by our proposal and at a price which would give us power at a somewhat lower figure. However, if our proposal with respect to Nitrate Plant No. 2 at Muscle Shoals is accepted, we would be able to postpone this development, which involves a large expenditure, and as a corollary would be able to hold this valuable waterpower in reserve for future requirements.

"When considering our proposal, we hope you will take into consideration the tremendous importance and value of the many years of experience which our large organization has had in electric furnace operation. This would aid greatly in working out the fertilizer problem in such a plant as Nitrate Plant No. 2.

"We think when you examine our proposal it will be obvious to you that we are disposed to enter into the agreement in question either direct with the government or with any leasee or purchaser of the project at Muscle Shoals."

The letter was addressed to the Secretary of War.

The offer is a proposal to lease Nitrate Plant No. 2, Waco Quarry and 50,000 hp. of power. The company agrees to take up an additional 50,000 hp. under certain conditions. It agrees to pay $150,000 per year for the use of the plant and the quarry.

The Carbide company plans to operate the plant to produce urea and phosphazote at cost plus 5 per cent. It agrees to conduct research and promises to maintain a production capacity of 40,000 tons of nitrogen for the full 50 years.

Government Subsidy to Ford

Among the points made at last week's hearing was a calculation showing that electricity produced at Muscle Shoals during 1926 would cost Mr. Ford less than one mill per kilowatt-hour of primary power. In 1936 it would reach its maximum cost at 1.9 mills per kilowatt-hour. This is one-sixth of the amount a similar volume of power would cost any other user. Based on the primary power alone at Muscle Shoals, this would make a difference of $15,000,000 per year. That is the amount, it was argued, that the government would be subsidizing Mr. Ford's industry.

News in Brief

Exposition of Southern Products—Plans for a great Southern exposition in which all the resources and products of the South will be exhibited in Grand Central Palace, New York, the last 2 weeks in January, 1925, have been announced by F. Roger Miller, business manager of the Macon, Ga., Chamber of Commerce. Mr. Miller is in Washington consulting various Southern Representatives and organizations before completing final arrangements.

Gas Students May Have A.G.A. Privileges—The executive board of the American Gas Association at a regular meeting held in New York, Dec. 19, approved an amendment to the association constitution which has been submitted to the entire membership for vote. This amendment makes eligible to Class C membership students in universities, colleges and scientific institutions with full privileges now accorded to that class of membership.

Will Rebuild Benzoate Plant — The Commonwealth Chemical Corporation, Newark, N. J., is planning for a complete reconstruction of its manufacturing plant for benzoate. The chlorination building, valued at $20,000, constructed mostly of glass, together with a large quantity of valuable apparatus, was recently destroyed by fire.

Ford Pushing Retort Plant—The Ford Motor Co., Detroit, Mich., is pushing construction on its new chemical plant at Iron Mountain, Mich., and expects to have a portion of the works ready for service at an early date. Agents are now in the field in the Peninsula section to purchase kiln wood for use in the chemical retorts. The main product of the retorts, it is said, will be charcoal, to be used for smelting ores for different service in connection with Ford automobile production.

Company to Produce Safety Devices—The Hugh Co., Buffalo, N. Y., has been organized to manufacture safety first appliances for industrial institutions. The officers of the new company are: E. C. Hugh, president and treasurer; John M. Brendel, vice-president and secretary; Alexander Cordes, Dr. Charles T. Crance, and James H. Dyett, directors. Mr. Hugh is a well known Buffalonian and was a member of the British War Ministry under the direction of the late Lord Northcliffe. This company maintains a consulting department which gives industrial advice on sheet metal machines, gear, chain and belt guards, motor covers and other devices.

To Make Glass Without Polishing—The prospects for the Canadian Glass Co., which proposes to make plate glass at Amherstburg, Ont., by a new process which it is said will entirely eliminate grinding and polishing, have been greatly improved by the discovery of a new deposit of the best grade of silica sand. An estimate of the size of the bed places it at about 7,000,000 tons, having a market value in the raw of over $17,000,000.

Carnegie Announces Metallurgy Fellowship—A new metallurgy fellowship of $750 for the 10-month school year is announced by the Carnegie Institute of Technology. The work to be done will be under the general supervision of the advisory board of the department of metallurgy and mining. The first problem to be studied under this fellowship is an investigation of the effects of small percentages of phosphorus on the physical properties of low-carbon steel, especially under alternating stresses and shock.

To Make Ferrous Sulphate—The Gulf States Steel Co. of Birmingham, Ala., has recently made arrangements to manufacture ferrous sulphate as a by-product at its Gadsden, Ala., mill. Approximately 4 tons per day is to be the output at present.

Premier Mill Corp. Has Fire—Laboratories and demonstrating equipment of the Premier Mill Corporation, Geneva, N. Y., were recently destroyed by fire. A new plant, to be ready in a few weeks, has already been projected. It is reported that the first shipment of these colloid mills has recently been made and that considerable interest by various chemical engineering industries has been shown in the apparatus.

Western Reserve Extends Activities—In response to repeated requests, Western Reserve University, Cleveland, Ohio, has just announced a series of evening courses in various branches of chemistry. Credit is given toward advanced degrees in the courses offered, which include organic, microscopy, nutrition and research.

Carbo Gas Kills Three—Carbo gas, manufactured by the Atlas Chemical Co., Toledo, Ohio, the experimental gas division of the Henry L. Doherty interests, killed three men on Jan. 13. The accident occurred in a valve pit into which the victims were led by the discovery of a leak.

New Testing Laboratory for Kansas City—Nathan Mnookin and Dr. Patrick, who have recently been doing special research work at the Kansas City branch of the Cudahy Packing Co., have established the Industrial Testing Laboratory there. Dr. Patrick was connected with the packing industry in South America for a number of years.

Kansas City A.C.S. Active

The January meeting of the Kansas City section of the American Chemical Society was held at the Chemistry Building of University of Kansas, Lawrence, Kan., Jan. 19. After the dinner, A. R. Sasse of the Southwestern Milling Co. of Kansas City addressed the meeting on the subject of "Problems Connected With the Bleaching of Flour." Also L. C. Hughes, consulting chemical engineer, of Kansas City, discussed "The Manufacture of Soda by the Ammonia Soda Process."

Reduction in Home Consumption Affects German Potash Output

Inland use of potash in Germany has fallen to the point where the Potash Syndicate is in a bad way and the productivity of German soil is being reduced greatly, according to a report on the potash industry reproduced by the British Department of Overseas Trade. The report, in part, is as follows:

"June of 1923 was the best sales month ever recorded by the industry and orders of German agriculture still were satisfactory in July, but stagnation in inland sales began in September. At first this was attributed to the precipitate tax legislation and to the method of collection. Later it was attributed to the currency chaos. Agriculture refused to sell its products for paper marks. The stable money which was promised for the delivery of cereals was not forthcoming.

"The issue of the renten-mark and the discount in kind, which the Potash Syndicate granted during November, called forth a temporary revival of business, which, however, came to a standstill immediately the provisions of the new property tax law became known. The small and the medium-sized agricultural undertakings, which cultivate more than 75 per cent of the soil in Germany, have almost ceased to apply artificial fertilizers to their land. Substantial restrictions have been effected by large land owners. A great decline in production is feared.

"The critical conditions in the market during the last 5 months of 1923 have compelled the potash industry to drop shifts everywhere and to dismiss many employees. As a result of the decline in sales and of the consequent necessity of restricting operations, the costs of production have increased.

"Foreign trade is satisfactory, but the taking over of new works and the raising of new capital has been postponed."

New Jersey Chemists Meet With Steel Treaters

A joint meeting of the New Jersey Chemical Society and the New York Chapter of the American Society for Steel Treating held in Newark on Jan. 14, was most successful and was attended by more than 300 members of the societies. The meeting, which was held at Stetters Restaurant, was preceded by an informal "get acquainted" dinner, at which about 150 members were present.

The feature of the evening was a talk by Jerome Strauss, metallurgist and materials engineer of the United States Naval Gun Factory, Washington, D. C., who discussed stainless steel and other corrosion-resisting metals. Mr. Strauss spoke about his investigation of these materials of construction, describing the advantages and disadvantages of each and their various abilities to resist the action of salt water and other corrosive liquids.

Washington News

John W. Wiseman Joins Chemical Division

John W. Wiseman, of New York, has been appointed to the Chemical Division of the Bureau of Foreign and Domestic Commerce in Washington and will take up his duties this week. Mr. Wiseman has had practical sales and executive experience in both foreign and domestic markets and is particularly well versed in the Far East and South American fields.

From 1909 to 1917 he was with Dodge & Seymour, after which he went with the Abandsey Co. Then entering the Naval Air Service, attached to the Naval aircraft factory at the Philadelphia Navy Yard, he was engaged in the purchase of materials and supplies. At the conclusion of the war he rejoined the Abandsey Co. and in 1920 went with the H. E. Voetegeli Co., of New York City, where he has been until accepting the position with the Department of Commerce.

Mr. Wiseman's 14 years of practical experience, supplemented by study at Alexander Hamilton Institute and Columbia University, has given him a thorough knowledge of foreign trade in heavy chemicals, drugs and natural products. He will devote his time to problems involving these groups.

Calcium Arsenate Trade Retarded by Tariff Agitation

The agitation for the removal of calcium arsenate from the dutiable list is bearing exactly the fruit expected by those familiar with the situation. Publication throughout the South of articles dealing with the introduction of bills proposing to put the commodity on the free list has given rise to a very general impression among farmers that the success of this legislation will mean a reduction of 25 per cent in the cost of the commodity. Reports reaching Washington indicate that purchases of calcium arsenate have slowed up materially, and the chief reason given is that farmers expect prices to go lower.

Due to the fact that the cotton farmer is in funds as a result of the high price obtained from last year's crop, it had been expected that a brisk demand for calcium arsenate would continue during the off season.

The effect of the proposed legislation to remove the duty, if passed, those well informed realize, would operate to increase the price rather than reduce it. There are no supplies of calcium arsenate to bring into the country. The removal of the duty, as has been pointed out frequently, can only increase the uncertainties of the situation and make for higher prices.

Information also has reached Washington that the smelting interests are not satisfied with the prices they are receiving for white arsenic. Unless it can be made more profitable for them, some interests at least are inclined to relinquish their effort to secure the maximum output of white arsenic.

Production of Gum Tragacanth in Turkey Back to Normal

Reporting on gum tragacanth production in Turkey, Hermon G. McMillan, clerk to the trade commissioner at Constantinople, states that in the years immediately preceding the World War, production is estimated to have been about 5,000 to 6,000 sacks annually. During the war it was greatly neglected and barely reached 1,500 sacks. A sack is equivalent to about 168 lb. Most of the peasants were in the army, and transportation was inadequate. Very small amounts were shipped to the central European countries until the last 2 years of the war, when the annual exports were from 800 to 1,000 sacks. Production rose steadily after the armistice and is now approximately 5,000 sacks per annum.

Definite information regarding the 1923 crop is not available. Reports which reach the market from farmer correspondents of local importers and from general sources are rather contradictory. However, it is believed in authoritative circles that the crop will yield approximately 5,000 sacks.

New Linoleum Factory in Australia

According to reports to the Department of Commerce, a new linoleum factory will be erected in Australia. A company organized some time ago has just let tenders for the construction of a factory at Clyde, New South Wales. The plant will cover an area of 5½ acres and will embody all the facilities found in the most modern linoleum factories in Scotland and France, which countries were visited by the engineer in charge. The machinery will be capable of turning out both 6- and 12-ft. widths. It is planned to have the factory ready for operation by April.

Legislation to Prevent Pollution Is Received Favorably

The Senate has passed and the Committee on Rivers and Harbors of the House is considering a bill intended to prevent the discharge of oil into the coastal waters of the United States.

The bill was passed by the Senate without a record vote. Senator Willis of Ohio, in charge of the bill on the floor, pointed out that the discharge of oil from floating craft and land plants has greatly increased the fire hazard because it is absorbed by piling supporting docks, warehouses and other structures. A secondary evil arising from oil pollution is the damage caused to oyster beds and to fish life. He also called attention to the fact that it also constitutes a nuisance at bathing beaches.

Some objection was voiced by Senator McKeller of Tennessee, prompted by the possibility that large expense would be incurred in efforts to enforce the act. Senator Willis expressed the opinion that the War Department could deal with the situation with its existing personnel.

A favorable report on the measure by the House committee is assured.

Claims Granted Against Germany

The Mixed Claims Commission on Jan. 22 announced awards of fifteen claims against Germany. These awards reached a total of more than $106,000. The commission also announced that eighteen other claims had been dismissed. Among the companies to whom awards were granted were E. I. du Pont de Nemours & Co., $21,243.29, and the Powers - Weightman - Rosengarten Co., $26,083.33.

Free Admission of Acetate of Lime Into Canada

In connection with the announcement of the previous week to the effect that acetate of lime from Canada would be admitted into this country free of duty, a report from Ottawa says the commissioner of customs and excise has added to the free list acetate of lime or calcium acetate used as a material by Canadian manufacturers. This regulation, which creates a new tariff item, become effective from Dec. 22, 1923. The above product was formerly dutiable under item 711 at a general rate of 17½ per cent ad valorem (15 per cent preferential) provided for articles not specified in the tariff.

Manifests Open to Examination

The Treasury Department has modified its previous ruling that only incorporated associations should be permitted to examine manifests. It is now announced that regularly established associations, whether or not they are incorporated, will be permitted to examine manifests and secure therefrom information and data on importations of such goods as may be of interest to the particular associations. This permission is granted only to the associations and does not extend to customs brokers or representatives of the individual importers.

Report on Italian Dye Industry Soon Available

An exhaustive report on the Italian dye industry has been received by the Chemical Division of the Department of Commerce from Dr. F. E. Breithut. No portion of the report will be given out until it has been printed and ready for general distribution. The report follows the style of Dr. Breithut's analysis of the Swiss industry, which recently was released. Dr. Breithut now is working on a similar report covering the French industry.

Opposing Views on Alcohol Taxation Explained at Recent Hearing

Stenographic Report of Hearing Makes Clear Why Removal of Excise Tax Does Not Meet With Universal Approval

THE diametrically opposed points of view in regard to the taxation of ethyl alcohol were set forth strikingly at the revenue revision hearing before the Committee on Ways and Means. The stenographic transcript of the testimony now is available. Frank A. Blair, of New York, speaking for the National Association of Manufacturers of Proprietary Medicines and Flavoring Extracts, said:

"This is a special tax imposed on an ingredient. I maintain there is no more reason why the tax on alcohol should continue than there should be a tax on the vanilla bean or on the lemon that goes into the extract. Alcohol is an ingredient, and still it is taxed. The tax is a relic of the days when alcohol was used for beverage purposes. Today we have no beverage alcohol. It is an industrial product. It is an absolutely necessary ingredient in the manufacture of a vast number of products. We manufacturers, who pay all the regular taxes that all other manufacturers pay, in addition are taxed this special amount on one of our ingredients."

The position of the American Drug Manufacturers' Association, as presented to the committee by Horace W. Bigelow, general attorney for Parke, Davis & Co., is:

"The members of the American Drug Manufacturers' Association, who manufacture 90 per cent of the medicinal products for use by physicians and druggists, are unequivocally opposed to the removal or the reduction of the tax on ethyl alcohol."

Arguments Against Reduction

The reasons were summed up as follows:

(1) It would undoubtedly let down the bars of prohibition enforcement to an extent that would be exceedingly demoralizing.

(2) Bootleggers who at present divert tax-free specially denatured alcohol to illegitimate purposes would undoubtedly attempt to operate under the guise of pharmaceutical manufacturers in order to obtain pure alcohol.

(3) It would greatly encourage promiscuous manufacturing of prescription medicines by the unskilled and would flood the country with low quality, untested, dangerous medicines which would be a menace to the public health.

(4) The tax is indirect and not included in the tax-reduction plan of the Secretary of the Treasury.

(5) It is highly improbable that there would be any reduction in the price of prescriptions or of so-called patent medicines to the ultimate consumer.

(6) The government would lose a revenue easily collected, which last year amounted to nearly $23,000,000.

(7) There would be a tremendous shrinkage in the inventory value of prescription products in the hands of manufacturers and wholesalers entailing a loss of millions of dollars without benefit to the ultimate consumer.

(8) Manufacturers of so-called patent medicines would not be required to reduce their prices, because such medicines are of a non-competitive character and the printed and advertised resale prices of the same are arbitrarily fixed by the manufacturer.

(9) It would be class legislation, because it would benefit but one class—namely, the manufacturers of so-called patent medicines.

(10) It would throw the pharmaceutical industry into chaos at a time when the executive and legislative departments of the government are bending every effort to stabilize business conditions generally.

William A. Sailer, general manager of Sharpe & Dohme, of Baltimore, and chairman of the Commissioner of Revenue's Advisory Alcohol Trades Committee, in the course of his statement to the committee, said:

"The tax on ethyl alcohol is an indirect one. It is something the great mass of the people do not feel. It is passed on to them in such small driblets that no one really knows he is paying it. If you take off the tax altogether, it will mean a reduction in our cost of more than 50 per cent on Galenical preparations. If you reduce the tax by one-half, it would mean a loss to us on our inventories of 40 per cent."

Cause of Pekin Explosion Discovered by Engineers

Investigation of Corn Products Plant After Disaster Indicates Cause Due to Heated Bearing

The disastrous explosion in the starch plant of the Corn Products Refining Co., Pekin, Ill., Jan. 3, in which forty-two persons were killed and twenty-one injured and property was damaged to the extent of approximately $1,000,000, was caused by a fire originating from an overheated bearing in a starch conveyor, according to the report of David J. Price, engineer of the Bureau of Chemistry of the United States Department of Agriculture, who, with Assistant Engineers Hylton R. Brown and Paul W. Edwards, co-operated with the State Fire Marshal and officials of the company in making a study of the wreckage.

The engineers found unmistakable evidence that the hot bearing had set fire to the inside of the conveyor box in the basement of one of the buildings. The progress of the explosion, as reported by some of the survivors, indicates that it started when one of the wagons loaded with dry starch in the kiln house was dumped into the conveyor. The dust cloud produced by the dumping was set off when it reached the fire in the conveyor box. The explosion (or rapidly burning fire) traveled through this conveyor to a cross-conveyor, and finally was communicated to the hoppers of the starch-packing house, where the most violent explosion occurred, resulting in the complete wrecking of this building. In the first building affected by the explosion little damage was done because of the large window area, a type of construction recommended by the department for buildings in which such explosions are likely to occur. In this case the windows were blown out and little damage was done to the walls and floors.

As a result of the thorough study of conditions producing this disaster and the behavior of the explosion, the investigators have obtained new information that will make possible the adoption of new control measures in all sorts of industrial plants where combustible dusts are produced. In the opinion of the engineers operations in which such dusts are produced in large quantities should be conducted in buildings well set apart from other buildings, and such operations as starch dumping and packing should be done in buildings with large window area and remote from the rest of the plant.

Canada Seeks Domestic Coal for Coke Production

The promising outlook for the use of byproduct coke as a domestic fuel has led the Dominion of Canada Fuel Board to have sixty-five samples of coal from the Maritime Provinces tested for their coking qualities in the fuel-testing laboratories at Ottawa. In respect to both low sulphur content and low ash fusibility, most of the samples did not come up to the standard of imported coals. The examination showed, however, that there are low-sulphur, high-fusible ash coals to be found in the Maritime Provinces.

American Company Reported as Buyer of Rubber Estates

According to a report from London, an American company, the identity of which was not divulged, has bought two rubber estates belonging to Batavia and General Plantation Trust companies, acquiring 326,375 shares of $5 par. One estate is at Kweeklust and the other at Weltevreben, Dutch East Indies. Purchasers are buying control of fifty other plantations and the minor holdings of fifty more, at a total cost of $20,000,000. Batavia Trust agents in London say American principals are working with a Dutch financial group.

American Engineering Council Executive Board Elected

A constitutional change of importance was made at the recent Washington meeting of the American Engineering Council of the Federated American Engineering Societies, when it was determined that the name American Engineering Council shall henceforth be applied to what is now the Federated American Engineering Societies, the latter title being dropped; that the American Engineering Council as it now exists shall be known as the "Assembly," and that the executive board in future shall be the administrative board. These changes are in nomenclature, not in function, and are in the direction of simplification and the prevention of confusion.

Representatives of national engineering organizations on the executive board of the Council for the coming year have been chosen as follows:

American Society of Mechanical Engineers: Dean M. E. Cooley, University of Michigan; Dean A. M. Greene, Jr., Princeton; F. K. Copeland, Chicago; L. P. Alford, Fred R. Low and Major Fred J. Miller, New York.

American Institute of Electrical Engineers: Colonel J. H. Finney, Washington; Prof. Dugald C. Jackson, Massachusetts Institute of Technology; C. E. Skinner, Pittsburgh; F. B. Jewett and L. F. Morehouse, New York.

M. G. Lloyd, chief of the Safety Section of the U. S. Bureau of Standards, will represent the American Society of Safety Engineers; S. H. McCrory, U. S. Bureau of Public Roads, the American Society of Agricultural Engineers, and H. E. Howe, Washington, the American Institute of Chemical Engineers.

For purposes of organization the country has been divided into eight districts, which will be represented on the executive board by the following:

District No. 1, Hubert E. Collins, Utica, N. Y.; District No. 2, W. H. Hoyt, Duluth, Minn.; District No. 3, C. R. Gow, Boston; District No. 4, Arthur R. Cruse, Philadelphia; District No. 5, John S. Barelli, New Orleans; District No. 6, C. M. Buck, Topeka, Kan.; District No. 7, O. H. Koch, Dallas, Tex.; District No. 8, J. C. Ralston, Spokane, Wash.

The St. Paul Engineers Club has been admitted to membership in the Council.

National Engineering Societies Start New Employment Service

More than 55,000 engineers may profit by an employment service about to be inaugurated by the National Engineering Societies. The problem of placement of services and also of obtaining satisfactory engineering services is to be handled in a new way.

Lack of sufficient funds has prevented these societies in the past from maintaining other than local "engineering employment clearing houses." Within the past few months, a policy has been inaugurated which is calculated to insure the needed funds to provide a truly national service, with offices in leading cities throughout the country. Under this policy the societies continue their financial support and this is supplemented by contributions from those deriving benefit from this enterprise, as no profit to anyone is to be taken, simply a self-supporting service. Contributions, if on a basis of but 25 per cent of the fees which must be necessarily exacted by a commercial agency, will make possible the realization of a national service.

With the new plan fully developed representatives of the employment service will visit those with positions available to get first-hand information as to the requirements of the job. Engineers seeking opportunities may arrange to obtain weekly by first-class mail the current list of openings. Their availability is also announced in the respective publications of the Engineering Societies.

Safety Engineers Hold Technical Session

On Jan. 22, the annual meeting of the American Society of Safety Engineers was held in conjunction with a meeting of the Engineering Section of the National Safety Council. This meeting covered one full day, with technical sessions morning and afternoon and an informal banquet with addresses by prominent speakers in the evening.

The morning session was devoted to the subject of accidents caused by material handling and the way in which these could be eliminated by the use of various types of labor-saving material-handling equipment. Ralph E. Prouty, safety engineer, Aetna Life Insurance Co., presided. David S. Beyer, vice-president, Liberty Mutual Insurance Co., spoke on causes of accidents in material handling, showing that strains were the chief cause and that often the foreman or other leader did not properly select his men for heavy work. Another large class of accidents is cuts and scratches from handling material, and here the danger of blood poisoning is great.

S. D. Campbell, The Lamson Co., Syracuse, N. Y., spoke on methods of handling which eliminate accident, with particular stress on the conveying equipment which reduced labor greatly, thereby reducing the number of men to whom material-handling accidents could occur. Arthur L. Lewis, president, Lewis-Shepard Co., Boston, Mass., brought out the same facts in connection with various types of factory trucks.

The afternoon session was opened by an illustrated talk on safety in electric welding and cutting by D. H. Deyoe, of the General Electric Co. Devices necessary for the protection of the operator were described in considerable detail. Mr. Deyoe was followed by H. S. Smith, of the Union Carbide & Carbon Corporation, a speaker well known to the safety engineers, who has spoken before them many times. He mentioned the precautions to be taken in handling gas welding equipment and stressed the necessity of educating the employees who are to have the care of this equipment. Dr. Charles Aheard, of the American Optical Co., talked on glare and gave some interesting facts regarding the effect of various kinds of radiant energy on the eyes.

After a general discussion on these three talks a paper on the hazard of fuel oil for domestic heating was presented by the New York City Fire Prevention Bureau.

Ambrose Swasey Honored With Fritz 1924 Medal

The John Fritz gold medal, the highest honor bestowed by the engineering profession in this country, has been awarded for 1924 to Ambrose Swasey, engineer, manufacturer and philanthropist of Cleveland, Ohio.

The award was made, according to the announcement, "for the building of great telescopes, the founding of the Engineering Foundation, and the invention and manufacture of fine machine tools, precision instruments and military and naval range finders."

The most notable of Mr. Swasey's many public benefactions was the establishment, through a gift of $500,000, of the Engineering Foundation as the joint research instrumentality of the four great national societies of civil, mining and metallurgical, mechanical and electrical engineers.

The medal was established in 1902 in honor of John Fritz of Pittsburgh, pioneer in the American iron and steel industry, and is awarded annually for notable scientific or industrial achievement. Previous recipients have been Alexander Graham Bell, General George W. Goethals, Guglielmo Marconi, Sir Robert Hadfield of London and Eugene Schneider of Paris, head of the Creusot works.

Mr. Swasey was born in Exeter, N. H., Dec. 19, 1846. He learned the machinist's trade in Hartford, Conn., afterward removing to Chicago. Since the early '80s he has resided in Cleveland, where with Worcester R. Warner he established the Warner & Swasey Co., of which he is now vice-chairman.

Cornell's New Chem. Lab. Opened

On Dec. 22 the new Baker Laboratory of Chemistry at Cornell University was dedicated with appropriate ceremonies. J. DuPratt White, vice-chairman of the board of trustees, presided at the exercises; Mr. Baker himself presented the keys of the building to President Livingston Farrand, who accepted them for the university; Prof. L. M. Dennis, head of the department of chemistry, spoke briefly on the significance of Mr. Baker's gift to the advancement of both the science and the art of chemistry. The guests then inspected the laboratory and its equipment, and were shown the operation of the mechanical features of the building.

Ceramic Society Ready for Atlantic City Meeting

A general meeting of unusual interest to plant executives as well as technical men will open the annual convention of the American Ceramic Society at the Hotel Traymore, Atlantic City, Feb. 4 to 9. Research is the theme of this opening program.

On Tuesday and Wednesday the seven industrial divisions of the society will meet as separate groups to discuss their individual problems. The program for the Refractories Division was announced on p. 130 of our Jan. 21 issue. While it is not possible to give in detail all of the divisional programs, some idea of the amount of technical data that will be presented may be gained from the following summary of the number of papers scheduled by each division: Art, 8 papers and 3 discussions; Enamel, 17 papers, 3 committee reports and 4 discussions; Glass, 24 papers; Heavy Clay Products, 28 papers; Refractories, 20 general papers, 4 on burning problems, 5 on consumers' problems, and a question box covering 24 practical subjects for lively discussion; Terra Cotta, 19 papers; White Wares, 20 papers.

Thursday, Friday and Saturday will be devoted to plant inspections in New Jersey, eastern Pennsylvania and Maryland, the details of which will be announced at the convention.

General Session Program

Monday, Feb. 4, 9:15 a.m.

Address by the president, A. F. Greaves-Walker; report of secretary, Ross C. Purdy.

Research and Trade Association Activity, Dr. H. E. Howe, editor, *Industrial & Engineering Chemistry*.

Value of Research to the Ceramic Industry, F. M. Dorsey, General Electric Co.

Massachusetts Institute of Technology Plan for Industrial Co-operation, Dr. C. L. Norton.

1:45 p.m.

How to Co-ordinate the Ceramic Laboratory With Plant Production, Dr. J. A. Jeffrey, president, Champion Porcelain Co.

How the Technical Man Can Help You, E. Olney Herman, A. D. Little Co.

Experiences That Have Resulted From Careful Research Work, W. R. Basset, Miller, Franklin, Basset & Co.

Economic Factors That Make Research in Industry Important, Ralph B. Wilson, Babson's Statistical Organization.

Large Pulpwood Shipments From Canada

Exports of pulpwood to United States from Canada increased almost 40 per cent in 1923, totaling 1,384,230 cords, against 1,011,332 in 1922. Value was $13,525,004, compared with $10,359,762, according to Bureau of Statistics. Fear of imposition of embargo on pulpwood exports was held responsible for large increase in shipments in 1923.

Trade Notes

G. North Cherrington, formerly manager of McKesson & Robbins, has joined the Potash Importing Corporation of America and will have charge of the heavy chemical department.

The plant of Sherwin-Williams Co. at Chicago has been largely destroyed by fire. Loss is estimated at $500,000.

The Texas Chemical Co. of Houston, Tex., will build a plant at Baton Rouge, La., for the manufacture of acids and chemicals.

With capital increased to $300,000, the Arkansas Lime Co. of Ruddells, Ark., has changed its name to the Batesville White Lime Co. and will develop 256 acres of land chemical lime manufacture.

The annual dinner of the Oil Trades Association of New York will be held at Waldorf-Astoria Hotel on Feb. 6.

Paul L. Butler and Gordon R. Fulton have severed their connections with Lever Bros. and have taken over the operation of the Kendall Manufacturing Co. at Providence, R. I.

Import duty on crystallized soda entering Switzerland has been increased from 1 franc to 4 francs per 100 kilos.

Sales of mercury in Spain in 1923 were twice as large in volume and in value as in 1922.

The properties of the American Cotton Oil Co., at Gretna, La., have been sold to Southern interests.

Akron Becoming Busy Center With Rubber Industries Active

With advancing production at the different rubber mills at Akron, Ohio, other industries in that locality are also developing maximum outputs, with expectation of continuing on this basis for an indefinite period. The Anaconda Copper Co. is operating full and now rushing completion of a new plant unit, designed to double the present capacity. The plant is devoted to the production of zinc oxide. The New Haven Sherardizing Co., which recently removed to Akron from Hartford, Conn., is running at peak output, the production being used exclusively by the local rubber mills. The National Sulphur Co. is operating at full capacity, giving employment to a regular working force, and is said to have orders on hand for continuance on this basis for a number of months to come. The Benzol Motor Fuel Co., which recently commenced operations in Akron, is expanding distribution, and will install additional equipment at its plant.

Pittsburgh to Have Special Chemical Engineering Lectures

During February and March a series of five public lectures on chemical engineering problems will be given at Carnegie Institute of Technology in Pittsburgh, under the joint auspices of the Institute and the Chemical Equipment Association. The series, according to the announcement, will be for the benefit of the executives and scientists of the Pittsburgh district. Special invitations to a large number of residents of the district have been issued by President Thomas S. Baker, of Carnegie Tech.

The series will cover important problems in the use of chemical equipment in chemical and metallurgical industries, and in many others that are usually considered as mechanical industries.

The schedule of lectures as announced by the Institute follows: Friday, Feb. 8, H. C. Parmelee, editor of *Chem. & Met.*, "The Relation of Chemical Equipment to the Pittsburgh Industries."

Thursday, Feb. 14, Prof. W. L. Badger, University of Michigan, "Evaporation."

Friday, March 7, A. E. Marshall, Baltimore, Md., "Mechanical Methods of Handling Chemical Plant Materials."

Thursday, March 13, F. M. Turner, Jr., Chemical Catalog Co., New York, "Crushing, Grinding, Sifting and Mixing Equipment."

Friday, March 20, Dr. Fred C. Zeisberg, chemical department of E. I. du Pont de Nemours & Co., "Equipment Phases of Nitric and Sulphuric Acid Manufacture."

New Boll-Weevil Poison Produced by New York Company

A new chemical compound said to possess much promise as a poison to be used in connection with boll-weevil control has been produced, according to claims laid before the Secretary of Agriculture and Dr. E. D. Ball, the director of research of that department. Until patent proceedings have progressed further, no announcement is being made as to the character of the compound or the names of the manuacturers interested. Senator Harrison of Mississippi, who introduced the manufacturers to Agriculture Department officials, is convinced that a very farreaching discovery has been made. Other than stating that the compound was developed by New York chemical manufacturers and that it is a poison, Senator Harrison withheld further information on the ground that the manufacturers must safeguard their own business interests before more information may be made public. He states that Agricultural Department officials regard the development seriously, despite the fact that many valueless concoctions, for which exaggerated claims are made, frequently are brought to the attention of the department.

Market Conditions

Orders for Spot and Prompt Delivery of Chemicals Gain in Volume

Buyers Show More Interest in Covering Requirements for Next Month—Contract Deliveries Continue on Large Scale

ACTIVE call for delivery of chemicals and allied products which was noted in the previous week is still in feature of the market and large amounts of basic materials are passing from production points. The spot market also was more active last week and consumers showed more inclination to place orders for first half of February. Dealers reported a quiet week and it is stated that most of current trading is direct between producers and consumers.

The weighted index number for the week shows a rather sharp decline. This resulted from the lower level at which crude cottonseed oil was selling with declines in nitrate of soda and other chemicals adding their weight to bring down the average level. Most of the heavy chemical list is on a steady basis and price fluctuations in them are regarded as improbable in the near future. Some large orders are reported to have been placed recently in denatured alcohol and a few large contracts for sulphuric acid have been noted. Arsenic, on the other hand, has been quiet and the failure of buyers to take on calcium arsenate as had been expected has unsettled the markets for both arsenic and arsenate. Call for fresh supplies of nitrate of soda also has been limited and the fall in exchange has brought out lower priced offerings. Good buying has featured sulphate of ammonia and prices for the latter have held firm.

The tin salts were strong throughout the week because of higher values for the metal and revised price schedules for the farmer are anticipated.

Acids

Mineral acids are reported to be moving freely but supplies of the various grades are sufficiently large to fill all wants. Prices are quotably unchanged but asking prices of $9 per ton for 60 deg. sulphuric acid in tanks at works have been shaded. Muriatic acid also is said to be easy at 90c. per 100 lb., f.o.b. producing points. Tartaric and citric acids are rather quiet but prices have been maintained at recent levels of 26½c. per lb. and 46½c. per lb. respectively. Oxalic acid has been under pressure and domestic makes are said to have sold at lower prices in eastern markets than at western points. Prices as low as 11½c. per lb. are heard and it is stated that this can be done for spot goods as well as f.o.b. producing points. Foreign oxalic is generally quoted fractionally higher than domestic. No change in price has been announced for acetic acid but large consumers are said to have been favored in placing contracts. Synthetic glacial acetic continues to compete with domestic-made glacial. Formic acid has maintained a steady tone under the influence of firm prices at primary points.

Arsenic Easier on Spot—Calcium Arsenate Sells Off—Tin Salts Strong—Nitrate of Soda Lower—Copper Sulphate Declines in Price—Nickel Salts Down—Prussiate of Soda Weak—Formaldehyde Firm—Oxalic Acid Weak

Potashes

Bichromate of Potash—This market has retained the tone of steadiness which has existed in recent weeks. Second hands are not playing much of a part in present trading and first hands are not shading prices. Most of the buying is held down to small lots and prices are on a sliding scale according to quantity. Open quotations range from 9⅝c. to 10c. per lb.

Caustic Potash — Imported material continues to dominate the market and has been holding a fairly steady course. Spot holdings are offered at 6½c. per lb. with moderate buying reported. Shipments from abroad are to be had at 6¼c. per lb., but most of the call is for prompt delivery and preference is given to spot material.

Permanganate of Potash — Domestic producers continue to offer at 14c. per lb., at works, and are willing to equalize freight rates so as to place delivered prices on a basis of competition with imported grades. Offerings of foreign material are heard at 14c. per lb., on spot, although replacement values are said to be considerably above that figure. Various consuming trades are said to be buying but large lot buying is not common.

Prussiate of Potash—The spot market for yellow prussiate shows some irregularities as reports credit sales at prices under the inside quotation of 22c. per lb. Domestic and imported grades are in close competition as regards market prices. The shipment price for imported varies from 20c. to 21c. per lb. with some importers holding to the outside figure. Red prussiate is quiet and prices are nominally given as 45@46c. per lb.

Sodas

Acetate of Soda—There is not much improvement in consuming demand but spot holdings have been well absorbed and producers are in control of the market. A firm tone to prices has resulted from the lessening of selling pressure and asking prices are given at 5½c. per lb. for round lots at works.

Bichromate of Soda — Competition comes to life occasionally when large buyers are in the market and it is stated that prices on contracts have been shaded in a few instances since the first of the year. In general the market is firm and if anything the tendency is toward a higher price level. Prompt shipment goods are held at 7½c. per lb. and upward on a quantity basis. Fair demand is reported for moderate sized lots and deliveries against contracts also are being made in good volume

Caustic Soda—This material appeared to be a little easier as far as export business was concerned. This was indicated by reports that outside brands could be purchased on a basis of $3.05 per 100 lb., f.a.s. New York. For standard brands the quotation remained at $3.10 per 100 lb., f.a.s. The contract price for domestic delivery is holding at $3.10 per 100 lb., at works. Ground and flake caustic are offered at $3.50 per 100 lb., at works. Jobbing lots in the spot market range from $3.76 to $3.91 per 100 lb.

Fluoride of Soda — Offerings of domestic are scarce and prices are little better than nominal. Imported grades have been reduced in volume by recent buying and the selling price is said to be firm at 9c. per lb. and upward according to amounts involved. Shipments also are firm and 9c. per lb. is the general asking price for forward deliveries.

Nitrate of Soda—Prices for material held at domestic points have been easy and buyers were more active at the lower levels. Sales of round lots were reported during the week at $2.40 per 100 lb. No open change has been made in the schedule governing future deliveries and the latter are better

maintained than spot values as resale lots are said to have weakened the latter. The decline in sterling was favorable for an easing off in nitrate values and if sustained may work in buyers' favor.

Nitrite of Soda—Large consumers are reported to be well covered by contracts and this leads to the belief that a very large part of domestic requirements for 1924 will be filled by imported nitrite, as domestic producers have not been operating in a way which would warrant their acceptance of large orders. Supplies of both domestic and imported are small at the moment with quotations at 8@8¼c. per lb.

Prussiate of Soda—Buyers are not attracted unless they are given price concessions and it is difficult to hold the market in a steady position. The quotation for spot prussiate is 11¼c. per lb., but it is not strong at that level and trade factors say it can be shaded. The same situation exists in the shipment market and offerings at 11c. per lb. are not bringing out buying orders.

Miscellaneous Chemicals

Arsenic—The situation is not entirely promising. In the first place some producers are said to be dissatisfied with prevailing price levels and therefore are not inclined to expand production. On the other hand present buying is slow and prices for imported grades are easing off under the slow trading movement. Spot material was quoted at 13c. per lb. in most directions but goods could be bought at 12¾c. per lb. and there was a rumor in the market that a sale was put through at 12⅝c. per lb.

Bleaching Powder—Production of bleaching powder is reported to be under that for the corresponding period last year. This accounted for the larger substitution of liquid chlorine for bleach in the paper trade. Stocks of bleach are admitted to be ample but they are in firm hands and no departures are heard from the open schedule of prices which establishes this material at $1.50 per 100 lb. in large drums, carlots, at works, and at $1.75 per 100 lb. for small drums.

Calcium Arsenate—The principal feature to the market is the slowness with which buyers are taking hold. A report from the South states that consumers are holding back under the impression that prices will go down. It is stated that agitation for placing calcium arsenate on the free list is a factor in checking buying on the part of southern consumers. In the meantime the lack of buying is depressing the market. There are offerings at 11¼c. per lb. at works and it was stated that some material changed hands during the week on a basis of 11c. per lb. at works.

Copper Sulphate—There were sales of domestic copper sulphate as low as 4½c. per lb. f.o.b. producing points. This emphasizes the fact that the market is in an easy position in spite of higher selling prices for the metal. Offerings of foreign sulphate were available at 4¼c. per lb. for shipment from abroad but they attracted very little attention.

Formaldehyde—Some of the leading producers are quoting 10¾c. per lb. and this appears to be an inside figure as 11c. per lb. is asked in some directions. Resale lots are not prominent and the bulk of stocks is in firm hands.

Nickel Salts—The market has been easier and sellers have offered at a lower price level. Moderate sized lots are offered at 10½c. per lb. for the single salt and at 10c. per lb. for the double.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	**164.00**
Last week	165.13
Jan., 1923	174.00
Jan., 1922	147.00
Jan., 1921	181.00
Jan., 1920	242.00
Jan., 1919	262.00
Jan., 1918	281.00

The decline in the weighted index number was brought about by the weakness in crude cottonseed oil and some of the items in the miscellaneous chemicals list.

Sulphate of Ammonia—Interest in this material was sustained throughout the period and only limited supplies are said to be in sellers' hands. Some producers are sold up for the present and this has placed a premium on nearby shipments. Export inquiry has been a feature although a good part of this inquiry did not result in sales. Prices for spot and prompt shipment sulphate are holding at $2.90 per 100 lb.

Alcohol

Producers reported a good volume of sales in denatured alcohol, large consumers taking on contracts on the old selling schedule. Prices underwent no quotable change. Special No. 1, carload lots, was offered at 45½c. per gal., in drums. Completely denatured, formula No. 5, carload lots, settled at 44½c. per gal., in drums. Ethyl spirits, U.S.P., 190 proof, was available at $4.78@$4.80 per bal., cooperage basis. Methanol prices were quotably unchanged, but the market, in some directions, was a little unsettled. First-hands quote 90c. per gal. on the pure, tank car basis. The 95 per cent grade in tank cars closed at 85c., with the 97 per cent at 88c., same basis.

Coal-Tar Products

Improved Demand for Benzene—Technical Benzaldehyde Lower—Phenol Stocks Light—Cresylic Unsettled

THE feature in the market was the better feeling in benzene, demand improving and prices steadying in all quarters. Some of the smaller producers were inclined to advance prices, as indications point to a higher selling basis for gasoline. Leading producers, however, announced no changes in the selling schedule for the coal-tar product, but, reported reduced holdings and a firm undertone. Sulphate of ammonia closed the week unchanged. Cresylic acid was unsettled under keen competition and prices in many instances were little more than nominal. The weakness in exchange made it possible to obtain supplies of crude material from abroad at moderate reductions. Crude naphthalene was offered freely for shipment from the Continent. Refined was steady in the local market, with production pretty well sold up. Phenol stocks were scanty and so far as spot prices were concerned the market closed in a more or less nominal position. Benzaldehyde was offered in a larger way and lower prices were heard in several directions.

Aniline Oil—First hands reported steady buying on the basis of 16c. per lb., drums extra, carload lots, nearby delivery. The market was firm.

Benzaldehyde—Competition resulted in offerings at lower prices on the technical grade, the market settling at 70c. per lb., in drums. There was no change in the U.S.P. and f.f.c. grades.

Benzene—The market gained further strength, but, up to the close of the week, producers held to the old selling basis of 21c. per gal. on the 90 per cent and 23c. per gal. on the pure water white, tank cars, f.o.b. works. Demand was good, the recent advance in gasoline stimulating buying interest.

Creosote—There was a good movement of creosote against existing contracts. Foreign markets held steady, Manchester quoting 9d. per gal., ex plant.

Cresylic Acid—Interest centered in the tariff hearing at Washington. The market was unsettled, prices ranging from 68@73c. per gal., according to quality. Demand was moderate only and competition quite keen.

Naphthalene—First hands report that contract business in flake has been satisfactory. The market was firm, flake closing at 6@6½c. per lb., as to quantity and seller. Chips held at 5¼@5½c. per lb. Crude to import was nominal at 2½@2⅝c. per lb., c.i.f. New York.

Phenol—Small lots of U.S.P. material sold at 32c. per lb., in drums. First hands had little to offer and the market on round lots for shipment was nominal at 26@29c. per lb.

Paranitraniline—There was a moderate call f[illegible] nearby material and the market held at 70@73c. per lb.

Solvent Naphtha—Stocks were moderate, production in most quarters being well sold up. Quotations were firm at 20c. for the crude and 23c. for the water white, tank car basis.

Vegetable Oils and Fats

Cottonseed Oil Declines—Linseed Futures Irregular—Olive Foots Advance—Palm Oils Firm—Tallow Steady

FAIRLY active trading took place in crude cottonseed oil, yet prices eased off on a rather bearish interpretation of the December statistics released recently by the Bureau of the Census. Linseed oil met with a moderate amount of buying at practically unchanged prices. Coconut was quiet, but steady. Olive oil foots advanced on higher cables from Italy. Demand for palm oils fell away, reflecting less anxiety on the part of soap makers in the tallow situation. Some buying of sesame oil for shripment from the Continent was reported late in the week.

Cottonseed Oil—Interest centered in the December statistics, which revealed that consumption of cottonseed oil met with another setback. The South indulged in switching operations in the option market, selling March against purchases of May oil. The locals applied a little pressure and the options in refined oil sold down to new lows for the movement. March prime summer yellow oil on Thursday sold at 11.02c. per lb., Produce Exchange contract. Crude refined oil sold at 9.30c. per lb., tank cars, mills, Southeast, and at 9.25c. per lb., tank cars, Texas common points, a decline of ¼c. Early in the week 50 cars of crude sold at 9½c., Southeast. Demand for refined oil was routine only, while lard compound trade showed no improvement. Compound prices went off ¼c. per lb., the market settling at 12¾@13c. per lb., carload basis. The amount of cotton ginned prior to Jan. 16 amounted to 9,946,462 running bales, which compares with 9,648,261 bales for the corresponding period a year ago. The ginnings were better than expected and private estimates on the crop now range from 10,100,000 to 10,200,000 bales. The Department of Agriculture's final estimate on the cotton crop, issued Dec. 12, was 10,081,000 bales.

Linseed Oil—Crushers reported a quiet market, with little variation in prices. Because of a rather steady market for new crop Argentine seed the tone favored sellers. Consumers had little confidence in the market and took on oil for nearby requirements only. Several tanks of February oil sold at 83c. per gal, equal to 89c. per gal., cooperage basis. In most instances, however, 91c. represented the inside figure on February oil. March-April was offered at 88c. per gal., with May forward at 86c. per gal., cooperage basis. On distant deliveries prices were irregular at all times, competition being keen. The Argentine crop, according to an estimate issued about a week ago, is placed at 64,000,000 bu., leaving an exportable surplus of 58,000,000 bu. The past week witnessed active buying by the Continent, which supported prices. American crushers stood ready to take on liberal quantities, but bids, in nearly all instances, were several cents under the market. Manchurian seed was offered in a limited way at $1.96 per bu., c.i.f. Pacific ports, March shipment from the Orient. Cake for export was easier, reflecting the drop in exchange, and the nominal price towards the close was $40 per ton, f.a.s. New York.

China Wood Oil—Prices were irregular in New York, but fairly steady at Hankow. Business was placed at 19¼c. per lb., tank cars, immediate shipment from the Pacific coast.

Cottonseed Oil Consumption Shows Decrease

Distribution of refined cottonseed oil for the first 5 months of the season amounted to 968,000 bbl., which compares with 1,166,000 bbl. for the same period a year ago. Consumption in December, according to an analysis of the official statistics, was 145,000 bbl., against 219,000 bbl. in November and 194,000 bbl. in December a year ago. The Bureau of the Census figures on cottonseed and cottonseed products, covering the 5 months ended Dec. 31, with a comparison, follow:

	1923	1922
Seed received, ton	2,723,086	2,818,126
Seed crushed, ton	1,995,504	2,036,746
Crude oil m'f'd., lb.	586,371,796	615,835,886
Ref'd oil m'f'd., lb.	396,083,249	448,794,287
Cake and meal, ton	912,650	924,924
Stocks, Dec. 31:		
Seed, ton	738,761	789,949
Crude oil, lb.	140,863,176	109,443,595
Refined oil, lb.	146,962,600	147,128,523
Exports, 5 months:		
Crude oil, lb.	12,900,735	10,931,512
Refined oil, lb.	6,502,902	23,394,694
Cake, ton	69,223	123,933

Coconut Oil—Few sales went over, yet prices were maintained in all quarters, the coast quoting 8⅛c. on Ceylon type oil, sellers' tanks, all positions, while in New York 9c. was asked.

Corn Oil—Several tanks of crude sold at 9⅞c., point of production, early in the week, but later 10c. was demanded by first hands, with offerings light.

Olive Oil Foots—Small lots on spot sold at 9⅞@10c. per lb. The market advanced to this basis on receipt of higher cables from Italy.

Palm Oil—Offerings were moderate and this sustained prices in a period of inactivity. Lagos held at 8c. per lb., with Niger at 7.20c. per lb., c.i.f. New York.

Sesame Oil—Buying of refined by American interests took place in Rotterdam last week. The shipment market closed nominally at 11⅝c. per lb., c.i.f. New York.

Rapeseed Oil—Refined closed at 84c. bid, spot delivery. On futures the market settled at 82@83c. per gal.

Soya Bean Oil — Prompt shipment from the Pacific coast was offered at 10c. per lb., tank cars, duty paid. In New York 10½c. per lb. was asked on March delivery crude.

Fish Oils—Newfoundland tanked cod oil held at 68c. per gal., with demand slow. Crude menhaden oil was nominally unchanged at 47½c. per gal., tank cars, factory.

Tallow, etc.—No important business was reported. The market on extra special held at 8⅝c. per lb., ex-plant, the last sale price. The undertone was barely steady. Yellow grease closed ¼c. lower at 7@7⅛c. per lb. Oleo stearine sold at 10⅛c., an advance of ⅛c. No. 1 oleo oil nominal at 16c. per lb. Red oil firm at 9¼@9½c. per lb., carload basis.

Miscellaneous Materials

Antimony—Sellers offer Chinese and Japanese brands, 10¼@10½c., an advance of ⅛c. W.C.C. brand, 11½@12c. Cookson's "C" grade, 12@12½c. Chinese needle antimony, lump, nominal, 7½@8½c. per lb. Standard powdered needle antimony (200 mesh), 8@9c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 8@8½c.

Barytes—Demand less active and easier prices named in some quarters. White floated offered at $23@$26 per ton, carload lots, f.o.b. St. Louis. Off color nominal at $14@$16 per ton, f.o.b. point of production. Crude $8.50 per ton, mines.

Glycerine—Offerings of dynamite reported at 15½c. per lb., carload basis. Chemically pure barely steady at 16½c. per lb. in New York territory, while 16c. has been named in the West. Soap lye crude offered at 10½c. per lb., loose f.o.b. point of production. Saponification crude nominal at 11⅞c. per lb., loose, carload basis.

Shellac — Market easier on drop abroad, T.N. closing at 58@59c. per lb. Bleached, bonedry, settled at 70@72c. per lb.

Naval Stores—The market opened firm, but eased a little later on. Turpentine settled at $1.03 per gal., in bbl., ex yard. Demand was routine only. Rosins held on the basis of $5.80 per bbl. for the lower grades. Savannah reported a steady market, with fair export inquiry.

White Lead—The metal market was again higher last week and this added to the steady tone of the lead products. Call for deliveries of white lead against contract is heard and new business is fair in volume. Former prices for the pigments are repeated with dry basic carbonate held at 9½c. per lb. in casks. Basic sulphate is quoted at 9c. per lb. Dry red lead is held at 11.15c. per lb. and litharge at 10.65c. per lb. Orange mineral holds at 15¼c. per lb.

Zinc Oxide—The metal was firm during the week and this condition was reflected in the oxide. Large consumers are taking regular deliveries against old orders and the movement from plants is holding up well. No price changes have been made and asking prices for American process, lead free, are 6⅞c. per lb. and upward.

Financial

The Texas Gulf Sulphur Co. will show earnings for 1923 of approximately $4,600,000, equivalent to over $7 a share on the 635,000 shares capital stock outstanding. This is the largest year's profit ever made by the company. Earnings in 1922 were $3,853,162 or $6.07 a share and in 1921 $1,949,375, equal to $3.07 a share after reserves.

A report from Akron says that the meeting of the B. F. Goodrich Co. directors for preferred dividend action has been postponed until Jan. 30.

At the annual meeting of the directors of the International Agricultural Corporation, S. B. Fleming and J. M. Goetchius resigned from the board. Other directors were re-elected.

The Pacific Mills reports a net profit for 1923 of $3,690,912, equal to $9.22 a share on the 400,000 outstanding shares. This compares with $1,354,594, or $6.70 a share earned on the 200,000 shares in 1922 just prior to the 100 per cent stock dividend.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	71½	74
Allied Chem. & Dye	71¼	69⅞
Allied Chem. & Dye pfd	111	110½
Am. Ag. Chem.	15⅞	15
Am. Ag. Chem. pfd.	45⅞	43⅞
American Cotton Oil c'f's.	11⅛	11⅜
American Cyanamid	*85	*84
Am. Drug Synd.	5⅞	6
Am. Linseed Co.	21⅛	20¼
Am. Linseed pfd.	44¼	41⅝
Am. Smelting & Refining Co.	58⅛	59
Am. Smelting & Refining pfd.	99	100
Archer-Daniels Mid. Co. w.i.	26½	26½
Archer-Daniels Mid. Co. pfd.	90	89½
Atlas Powder	53	*53
Casein Co. of Am.	*66	*66
Certain-Teed Products	35½	33⅞
Commercial Solvents "A"	42	*42
Corn Products	159⅞	174½
Corn Products pfd.	120	*120
Davison Chem.	64⅞	63⅞
Dow Chem. Co.	*47	*47
Du Pont de Nemours	131½	130
Du Pont de Nemours db.	85½	85⅞
Freeport-Texas Sulphur	12⅞	11⅞
Grasselli Chem.	*125	*125
Grasselli Chem. pfd.	*102	*102
Hercules Powder	*104	*104
Hercules Powder pfd.	*103	*103
Heyden Chem.	1½	2½
Intn'l Ag. Chem. Co. (new)	5¼	5½
Int'l Ag. Chem. pfd.	9¼	9¼
Int'l Nickel	13⅝	13
Int'l Nickel pfd.	80	80⅞
Int'l Salt	89½	*89½
Mathieson Alkali	38	38
Merck & Co.	*62	*60
National Lead	138½	144⅞
National Lead pfd.	112	112⅞
New Jersey Zinc	*149	*151
Parke, Davis & Co.	80	80
Pennsylvania Salt	*87	*87½
Procter & Gamble	*130	*130
Sherwin-Williams	31	31
Sherwin-Williams pfd.	101	101
Tenn. Copper & Chem.	9	9½
Texas Gulf Sulphur	63	62½
Union Carbide	58⅞	57⅞
United Drug	81½	*81½
United Dyewood	*40	*40
U. S. Industrial Alcohol	70⅞	74⅞
U. S. Industrial Alcohol pfd.	*98	100½
Va.-Car. Chem. Co.	9⅞	7⅞
Va.-Car. Chem. pfd.	32½	27½

*Nominal. Other quotations based on last sale.

Hamilton Byproducts Plant Will Produce Foundry Coke

To manufacture a new Canadian product in a plant which in style of construction is different from any other in existence in the world is the achievement which the Hamilton By-product Coke Ovens, Ltd., will shortly have completed at Hamilton, Ont. The product is foundry coke, which at present is imported in large quantities from the United States. Three hundred men have been employed on construction since last May and from 80 to 100 will be employed in two 12-hour shifts when the plant starts operating shortly. Besides the foundry coke, the plant will turn out as byproducts domestic coke, gas for the city of Hamilton, ammonium sulphate and tar.

The whole process is designed for economical operation. Automatic machinery replaces human labor wherever practicable and highly skilled labor is required in only a few places. The company has left room for expansion in all departments so that additional machinery and equipment can be installed without altering the layout of the works. P. V. Byrnes, the president of the company, is also president of the United Gas & Fuel Co. of Hamilton, Ltd.

Imports at Port of New York

January 18 to January 24

ACIDS—Cresylic—12 dr., Liverpool, W. E. Jordan & Bros. **Tartaric**—100 bbl. and 50 csk., Rotterdam, W. Benkert & Co.; 308 csk., Rotterdam, Order.

ALBUMEN—10 csk. blood, Liverpool, W. A. Ross & Bro.

ALUMINA HYDRATE—22 csk., Hamburg, A. Hurst & Co.

AMMONIUM CARBONATE — 10 csk., Liverpool, Order; 23 csk., Liverpool, Order.

ANTIMONY — 64 cs., Shanghai, F. A. Cundill & Co.; 400 cs. crude, Shanghai, Harshaw, Fuller & Goodwin Co.; 200 bbl., Havre, Heemsoth, Basse & Co.

ANTIMONY REGULUS—200 cs., Shanghai, Wah Chang Trading Co.

ARSENIC — 200 cs., Melbourne, Irving Bank-Col. Trust Co.; 1 cs., Melbourne, I. S. Haines; 30 csk., Bordeaux, Order.

BARIUM NITRATE — 31 csk., Rotterdam, A. Klipstein & Co.; 58 bbl., Hamburg, Meteor Products Co.

BARYTES—300 bg., Bremen, Order.

BONE BLACK — 932 bg., Bordeaux, Pomeroy & Fisher.

BRONZE POWDER—4 cs., Bremen, Order; 57 cs., Bremen, Baer Bros.; 32 cs., Bremen, Gerstendorfer Bros.

CALCIUM NITRATE—36 csk., Christiania, Order.

CASEIN—867 bg., Buenos Aires, Kaltfleisch Corp.

CHALK — 2,500 tons, Dunkirk, Order; 350 pkg., Bristol, H. J. Baker & Bro.; 40 csk., Bristol, Schieffelin & Co.

CHEMICALS—20 cs., Rotterdam, H. A. Metz & Co.; 350 csk., Rotterdam, Chemical National Bank; 500 bg., Rotterdam, P. Uhlich & Co.; 160 carboys, Rotterdam, Roessler & Hasslacher Chemical Co.; 60 pkg., Rotterdam, Order; 41 csk. and 9 cs., Hamburg, Jungmann & Co.; 10 cs., Hamburg, Norvell Chemical Corp.

CHROME ORE—500 tons, Beira, E. J. Lavino & Co.

COAL-TAR DISTILLATE — 152 dr., Liverpool, Order.

COLORS — 53 bbl. and 6 cs. aniline, Genoa, Irving Bank-Col. Trust Co.; 6 pkg. aniline, Buenos Aires, National Aniline & Chemical Co.; 2 csk. aniline, Rotterdam, Carbic Color & Chemical Co.; 10 kegs anniline, Rotterdam, National City Bank; 9 pkg. do., Rotterdam, American Exchange National Bank; 21 pkg. aniline, Rotterdam, Kuttroff, Pickhardt & Co.; 12 pkg. aniline, Rotterdam, H. A. Metz & Co.; 15 csk. bleachers blue, Liverpool, A. De Ronde & Co.

COPPERAS — 48 bbl. green, Liverpool, Order.

CORUNDUM ORE—352 bg. Port Natal, Standard Bank of South Africa.

CUTCH—1,000 bg., Singapore, Order.

DEXTRINE—425 bg., Copenhagen, Stein, Hall & Co.

FULLERS EARTH — 200 bg., London, Order; 250 bg., London, L. A. Salomon & Bros.

FUSEL OIL—7 dr., Dunkirk, Order.

GARNET ORE—4,200 bg., Almeria, H. Berk & Co.

GLAUBER SALT—500 bg., Hamburg, E. Suter & Co.

GLYCERINE—25 dr., Havana, Harshaw, Fuller & Goodwin Co.; 20 dr. crude, Dunkirk, Order.

GUMS—24 bl. chicle, Belize, H. Triest & Co.; 350 bl. do., Belize, D. L. Clark & Co.; 216 bg. do., Belize, Chicle Development Co.

IRON OXIDE — 34 csk., Bristol, Reichard-Coulston, Inc.; 160 bg., Bristol, G. Z. Collins & Co.; 22 csk., Liverpool, E. M. & F. Waldo; 12 csk., Liverpool, J. A. McNulty.

IRON PERCHLORIDE—33 bbl., Rotterdam, Brown Bros. & Co.

OILS—Cod—125 csk., St. Johns, R. Badcock & Co.; 150 csk., St. Johns, National Oil Products Co. **Coconut** — 655 tons (bulk), Manila, Order. **Sesame**—50 bbl., Rotterdam, Order.

PLUMBAGO—42 bbl., Colombo, H. W. Peabody & Co.; 200 bbl., Colombo, Order.

POTASSIUM SALTS—32 csk. carbonate, Bremen, P. H. Petry & Co.; 100 dr. caustic, Hamburg, Peters, White & Co.; 141 dr. caustic, Hamburg, P. Stabenow.

PYRIDINE—4 dr. refined, Havre, Order.

QUEBRACHO—1,156 bg., Buenos Aires, Beekman, Winthrop & Co.; 5,301 bg., Buenos Aires, Order.

QUICKSILVER — 300 flasks, Genoa, Order.

ROCHELLE SALT—66 bbl., Rotterdam, Order.

SHELLAC—700 bg., Calcutta, National City Bank; 300 bg. and 35 cs., Calcutta, Brown Bros. & Co.; 100 bg., Calcutta, Mechanics & Metals National Bank; 450 bg. refuse, Calcutta, Bank of the Manhattan Co.; 1,175 bg., Calcutta, Order.

SILVER SULPHIDE—7 cs., Pacasmayo, W. R. Grace & Co.

SODIUM SALTS — 21 csk. prussiate, Liverpool, Order; 80 cs. cyanide, Liverpool, Order; 100 dr. sulphite, Bristol, R. F. Downing & Co.; 10 csk. phosphate, Rotterdam, Order; 36 csk. prussiate, Liverpool, Order; 77 dr. sulphite, Hamburg, C. S. Grant & Co.; 62 csk. nitrate and 3,795 bg. do., Christiania, Order; 254 bg. silica fluoride, Copenhagen, Order; 11 csk. prussiate, Liverpool, C. Tennant Sons & Co.; 200 dr. cyanide, Liverpool, Order.

TALC—410 bg., Genoa, Kountze Bros.; 2,000 bg., Genoa, Italian Discount & Trust Co.; 300 bg., Genoa, C. B. Chrystal Co.; 500 bg., Bordeaux, Hammill & Gillespie.

TARTAR—1,220 bg., Buenos Aires, Order; 138 bg., Rotterdam, C. Pfizer & Co.; 33 csk., Rotterdam, Royal Baking Powder Co.

TUNGSTEN ORE — 443 cs., Shanghai, Wah Chang Trading Co.

WAXES—47 cs. beeswax, Liverpool, Order; 3 pkg. do., Monte Christi, Order; 119 bg. beeswax, Lisbon, J. H. Schroeder Banking Corp.; 25 bg. beeswax, Havana, Order; 167 bg. carnauba, Parnahyba, Strohmeyer & Arpe Co.; 1,125 bg. do., Parnahyba, National City Bank; 112 bg. do., Parnahyba, Order; 79 bg. do., Cara, Order; 583 bg. beeswax, Liverpool, Order.

WOOL GREASE — 50 bbl., Hamburg, American Exchange National Bank; 25 bbl., Hamburg, R. W. Greeff & Co.

ZINC OXIDE—50 bbl., Havre, Bernard Judae & Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums	lb.	$0.25 –	$0.25½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.63
Acetic, 56%, bbl.	100 lb.	6.75 –	7.00
Acetic, 80%, bbl.	100 lb.	9.58 –	9.83
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.78
Boric, bbl.	lb.	.10 –	....
Citric, kegs	lb.	.46½–	.48
Formic, 85%	lb.	.13 –	.13½
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.11½–	.12
22% tech., light, bbl.	lb.	.05½–	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks	100 lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½–	.05
Nitric, 42°, carboys	lb.	.05¼–	.05½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.11¾–	.12½
Phosphoric, 50% carboys	lb.	.07½–	.08½
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	15.00 –	16.00
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.26½–	.27
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.81 –	....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.78 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½–	...
No. 1, 190 proof, special, dr.	gal.	.45½–	...
No. 1, 188 proof, bbl.	gal.	.52½–	...
No. 1, 188 proof, dr.	gal.	.48½–	...
No. 5, 188 proof, bbl.	gal.	.50½–	...
No. 5, 188 proof, dr.	gal.	.44½–	...
Alum, ammonia, lump, bbl.	lb.	.03½–	.04
Potash, lump, bbl.	lb.	.03 –	.03½
Chrome, lump, potash, bbl.	lb.	.05½–	.06
Aluminum sulphate, com., bags	100 lb.	1.40 –	1.50
Iron free bags	lb.	2.40 –	2.50
Aqua ammonia, 26°, drums	lb.	.07 –	.07½
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. tech., casks	lb.	.09 –	.09½
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	4.50 –	4.75
Antimony oxide, white, bbl.	lb.	.08 –	.08½
Arsenic, white, powd., bbl.	lb.	.12½–	.13
Arsenic, red, powd., kegs	lb.	.15 –	.15½
Barium carbonate, bbl.	ton	66.00 –	68.00
Barium chloride, bbl.	ton	84.00 –	90.00
Barium dioxide, 88%, drums	lb.	.17½–	.18
Barium nitrate, casks	lb.	.07½–	.08
Blanc fixe, dry, bbl.	lb.	.04 –	.04½
Bleaching powder, f.o.b. wks., drums	100 lb.	1.50 –	....
Spot N. Y. drums	100 lb.	2.55 –	2.60
Borax, bbl.	lb.	.05¼–	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr.	lb.	.11¼–	.11½
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½–	.07
Camphor, cases	lb.	.82 –	.83
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.09 –	.09½
Chalk, precip.—domestic, light, bbl.	lb.	.04¼–	.04½
Domestic, heavy, bbl.	lb.	.03½–	.04
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04 –	.04½
Contract, tanks, wks.	lb.	.03½–	....
Cylinders, 100 lb., wks.	lb.	.05½–	.06
Cylinders, 100 lb., spot	lb.	.08½–	.09
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 –	18.00
Copper carbonate, bbl.	lb.	.18 –	.19
Copper cyanide, drums	lb.	.47 –	.50
Coppersulphate, dom., bbl.	100 lb.	4.65 –	4.75
Imp bbl	100 lb.	4.37½–	4.50
Cream of tartar, bbl.	lb.	.22½–	.24
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.00 –	1.05
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 –	2.50
Ether, U.S.P., resale, dr.	lb.	.13 –	.15
Ethyl acetate, 85%, drums	gal.	1.10 –	....
Ethyl acetate, 99%, dr.	gal.	$1.25 –	....
Formaldenyde, 40%, bbl.	lb.	.10¼–	$0.11
Fullers earth—f.o.b. mines	ton	18.00 –	20.00
Furfurol, works, bbl.	lb.	.25 –	....
Fusel oil, ref., drums	gal.	.... –	....
Fusel oil, crude, drums	gal.	4.00 –	4.25
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, c.p., drums extra	lb.	.16½–	.17
Glycerine, dynamite, drums	lb.	.15½–	.16
Glycerine, crude 80%, loose	lb.	.10½–	....
Hexamethylene, drums	lb.	.70 –	.75
Lead:			
White, basic carbonate, dry, casks	lb.	.09½–	....
White, basic sulphate, casks	lb.	.09 –	....
White, in oil, kegs	lb.	.11½–	.11¾
Red, dry, casks	lb.	.11½–	.11¾
Red, in oil, kegs	lb.	.13½–	.14¾
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl.	lb.	.18 –	.20
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10¼–	.10½
Lithopone, bags	lb.	.06½–	.06¾
in bbl.	lb.	.06¾–	.06¾
Magnesium carb., tech., bags	lb.	.08½–	.08½
Methanol, 95%, bbl.	gal.	.93 –	....
Methanol, 97%, bbl.	gal.	.95 –	....
Methanol, pure, tanks	gal.	.90 –	....
drums	gal.	1.00 –	....
bbl	gal.	1.05 –	....
Methyl-acetone, t'ks.	gal.	1.15 –	....
Nickel salt, double, bbl.	lb.	.10 –	.10½
Nickel salts, single, bbl.	lb.	.10½–	.11
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.... –	....
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½–	....
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½–	.06¾
Potassium chlorate, powd.	lb.	.07½–	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.08½–	.08¾
Potassium hydroxide (caustic potash) drums	lb.	.06½–	.06¾
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.07¼–	.09
Potassium permanganate, drums	lb.	.14 –	.14½
Potassium prussiate, red, casks	lb.	.45 –	.48
Potassium prussiate, yellow, casks	lb.	.22 –	.22½
Salammoniac, white, gran., casks, imported	lb.	.06½–	....
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Sait cake (bulk)	ton	22.00 –	24.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	3.10 –	....
Sodium acetate, works, bbl.	lb.	.05 –	.05½
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½–	.07¾
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04¾
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½–	$0.10¾
Sodium hyposulphite, bbl.	lb.	.02½–	.02¾
Sodium nitrite, casks	lb.	.08 –	.08½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03¾–	.04
Sodium prussiate, yel. drums	lb.	.11 –	.11½
Sodium salicylic, drums	lb.	.40 –	.42
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03 –	.03½
Sodium sulphite, crys., bbl.	lb.	.03½–	.03¾
Strontium nitrate, powd., bbl.	lb.	.11½–	.12
Sulphur chloride, yel drums.	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.13½–	.13¾
Tin oxide, bbl.	lb.	.51 –	.....
Tin crystals, bbl.	lb.	.34½–	.35
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06½–	.06¾
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, , lead free, bag	lb.	.06½–	.06¾
5% lead sulphate, bags	lb.	.06¾–	.07¼
10 to 35 % lead sulphate, bags	lb.	.06½–	.06¾
French, red seal, bags	lb.	.09¾–	......
French, green seal, bags	lb.	.10¾–	......
French, white seal, bbl	lb.	.12 –	......
Zincsulphate, bbl.	100 lb.	2.75 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.70
Alpha-naphthol, ref., bbl.	lb.	.65 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthracene, 80%, imp., drums, duty paid	lb.	.65 –	.70
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	.....
f.f.c. drums	lb.	1.60 –	.....
tech, drums	lb.	70	.....
Benzene, pure, water-white, tanks, works	gal.	.23 –	....
Benzene, 90%, tanks, works	gal.	.21 –	....
Benzidine base, bbl.	lb.	.80 –	.84
Benzidine sulphate, bbl.	lb.	.72 –	.75
Benzoic acid, U.S.P., kegs	lb.	.85 –	88
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref., carboys	lb.	.40 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.75 –	.80
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.72 –	.74
95-97%, drums, works	gal.	.68 –	.70
Dichlorbenzene, drums	lb.	.06 –	.08
Diethylaniline, drums	lb.	.49 –	.51
Dimethylaniline, drums	lb.	.38 –	.39
Dinitrobenzene, bbl.	lb.	.18 –	.20
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.30 –	.35
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.75 –	.80
Meta-phenylenediamine, bbl.	lb.	.95 –	1.00
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.06½–	.06¾
Naphthalene, balls, bbl.	lb.	.07 –	.07½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl.	lb.	1.10 –	1.15
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.15 –	.17
Ortho-nitrophenol, bbl.	lb.	1.20 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.14 –	.16
Para-amiñophenol, base, kegs	lb.	1.30 –	....
Para-amiñophenol, HCl, kegs	lb.	1.55 –	....
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraaniline, bbl.	lb.	.70 –	.72
Para-nitrotoluene, bbl.	lb.	.58 –	.60
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.88 –	.90
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.32
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	
Pyridine, imp., drums	gal.	4.00 –	4.25
Resorcinol, tech., kegs	lb.	1.40 –	1.50

Resorcinol, pure, kegs	lb.	$2.15 – ....
R-salt, bbl	lb.	.55 – .60
Salicylic acid, tech., bbl	lb.	.33 – ....
Salicylic acid, U.S.P., bbl	lb.	.35 – ....
Solvent naphtha, water-white, tanks	gal.	.23 – ....
Crude, tanks	gal.	.20 – ....
Sulphanilic acid, crude, bbl	lb.	.18 – .20
Thiocarbanilide, kegs	lb.	.35 – .38
Tolidine, bbl	lb.	1.00 – 1.05
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars, works	gal.	.24 – ....
Toluene, drums, works	gal.	.29 – ....
Xylidine, drums	lb.	.50 – ....
Xylene, pure, drums	gal.	.44 – .48
Xylene, com., drums	gal.	.32 – .34
Xylene, com., tanks	gal.	.27 – .29

Naval Stores

Rosin B-D, bbl	280 lb.	$5.80 – ....
Rosin E-I, bbl	280 lb.	5.90 – ....
Rosin K-N, bbl	280 lb.	6.25 – $6.75
Rosin W.G.-W.W., bbl	280 lb.	7.65 – 7.85
Wood rosin, bbl	280 lb.	5.80 – 5.90
Turpentine, spirits of, bbl	gal.	1.03 – 1.04
Wood, steam dist., bbl	gal.	.88 – ....
Wood, dest. dist., bbl	gal.	.72 – ....
Pine tar pitch, bbl	200 lb.	5.50 – ....
Tar, kiln burned, bbl	500 lb.	11.00 – ....
Retort tar, bbl	500 lb.	11.00 – ....
Rosin oil, first run, bbl	gal.	.45 – ....
Rosin oil, second run, bbl	gal.	.47 – ....
Rosin oil, third run, bbl	gal.	.50 – ....
Pine oil, steam dist	gal.	.65 – ....
Pine oil, pure, dest. dist	gal.	.60 – ....
Pine tar oil, ref	gal.	.48 – ....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla	gal.	.32 – .32½
Pine tar oil, double ref., bbl	gal.	.... – .75
Pine tar, ref., thin, bbl	gal.	.... – .25
Pinewood creosote, ref., bbl	gal.	.... – .52

Animal Oils and Fats

Degras, bbl	lb.	$0.04 – $0.04½
Grease, yellow, loose	lb.	.06½ – .07
Lard oil, Extra No. 1, bbl	gal.	.85 – ....
Neatsfootoil 20 deg. bbl	gal.	1.33 – ....
No. 1, bbl	gal.	1.00 – ....
Oleo Stearine	..	.10½ – ....
Oleo oil, No. 1, bbl	lb.	.16 – ....
Red oil, distilled, d.p. bbl	lb.	.09¼ – .09½
Saponified, bbl	lb.	.09¼ – .09½
Tallow, extra, loose	lb.	.08½ – ....
Tallow oil, acidless, bbl	gal.	.86 – .88

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.14½ – ....
Castor oil, No. 1, bbl	lb.	.15 – ....
Chinawood oil, bbl	lb.	.20 – .20½
Coconut oil, Ceylon, bbl	lb.	.10¼ – .10½
Ceylon, tanks, N.Y	lb.	.08¾ – ....
Coconut oil, Cochin, bbl	lb.	.10½ – .10¾
Corn oil, crude, bbl	lb.	.12 – ....
Crude, tanks, (f.o.b. mill)	lb.	.10 – ....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½ – .09¾
Summer yellow, bbl	lb.	.11¾ – .12
Winter yellow, bbl	lb.	.12½ – .12¾
Linseed oil, raw, car lots, bbl	gal.	.91 – ....
Raw, tank cars (dom.)	gal.	.85 – ....
Boiled, cars, bbl. (dom.)	gal.	.93 – ....
Olive oil, denatured, bbl	gal.	1.10 – 1.12
Sulphur, (foots) bbl	lb.	.09¾ – .10
Palm, Lagos, casks	lb.	.08 – ....
Niger, casks	lb.	.07¾ – ....
Palm kernel, bbl	lb.	.09¾ – ....
Peanut oil, crude, tanks (mill)	lb.	.12½ – ....
Peanut oil, refined, bbl	lb.	.15 – .15½
Perilla, bbl	lb.	.14½ – .14¾
Rapeseed oil, refined, bbl	gal.	.84 – ....
Rapeseed oil, blown, bbl	gal.	.88 – ....
Sesame, bbl	lb.	.12¾ – .13
Soya bean (Manchurian), bbl.	lb.	.... – ....
Tank, f.o.b. Pacific coast	lb.	.10 – ....
Tank, (f.o.b. N.Y.)	lb.	.10½ – ....

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.68 – ....
Menhaden, light pressed, bbl.	gal.	.65 – ....
White bleached, bbl	gal.	.67 – ....
Blown, bbl	gal.	.71 – ....
Crude, tanks (f.o.b. factory)	gal.	.47½ – ....
Whale No. 1 crude, tanks, coast	lb.	...... – ....
Winter, natural, bbl	gal.	.75 – .76
Winter, bleached, bbl	gal.	.78 – .79

Oil Cake and Meal

Coconut cake, bags	ton	$34.00 – ....
Cottonseed meal, f.o.b. mills	ton	45.00 – ....
Linseed cake, bags	ton	40.00 – ....
Linseed meal, bags	ton	42.00 – ....

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.45 – $0.50
Albumen, egg, tech, kegs	lb.	.95 – .97
Cochneal, bags	lb.	.32 – .34
Cutch, Borneo, bales	lb.	.04½ – .04¾
Cutch, Rangoon, bales	lb.	.14½ – .15
Dextrine, corn, bags	100 lb.	3.59 – 3.69
Dextrine, gum, bags	100 lb.	3.89 – 3.99
Divi-divi, bags	ton	38.00 – 39.00
Fustic, sticks	ton	30.00 – 35.00
Fustic, chips, bags	lb.	.04 – .05
Gambier com., bags	lb.	.10¾ – .11¼
Logwood, sticks	ton	25.00 – 26.00
Logwood, chips, bags	lb.	.02½ – .03
Sumac, leaves, Sicily, bags	ton	90.00 – .....
Sumac, gruond, bags	ton	$85.00 – $90.00
Sumac, domestic, bags	ton	40.00 – 42.00
Starch, corn, bags	100 lb.	3.02 – 3.12
Tapioca flour, bags	lb.	.06 – .07

Extracts

Archil, conc., bbl	lb.	$0.16½ – $0.20
Chestnut, 25% tannin, tanks.	lb.	.02 – .03
Divi-divi, 25% tannin, bbl	lb.	.04 – .05
Fustic, crystals, bbl	lb.	.20 – .22
Fustic, liquid, 42°, bbl	lb.	.08 – .09
Gambier, liq., 25% tannin, bbl.	lb.	.09¼ – .09¾
Hematine crys., bbl	lb.	.14 – .18
Hemlock, 25% tannin, bbl	lb.	.03½ – .04
Hypernic, solid, drums	lb.	.24 – .26
Hypernic, liquid, 51°, bbl	lb.	.09½ – .10½
Logwood, crys., bbl	lb.	.14 – .15
Logwood, liq., 51°, bbl	lb.	.08 – .09
Quebracho, solid, 65% tannin, bbl	lb.	.05 – .05¼
Sumac, dom., 51°, bbl	lb.	.06½ – .07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.06½ – $0.08½
spot, cases	lb.	.10 – .14
Lampblack, bbl	lb.	.12 – .40
Mineral, bulk	ton	35.00 – 45.00
Blues–Bronze, bbl	lb.	.40 – .43
Prussian, bbl	lb.	.40 – .43
Ultramarine, bbl	lb.	.08 – .35
Browns, Sienna, Ital., bbl	lb.	.06 – .14
Sienna, Domestic, bbl	lb.	.03½ – .04
Umber, Turkey, bbl	lb.	.04 – .04½
Greens–Chrome, C.P. Light, bbl	lb.	.28 – .30
Chrome, commercial, bbl	lb.	.12 – .12½
Paris, bulk	lb.	.26 – .28
Reds, Carmine No. 40, tins	lb.	4.50 – 4.70
Iron oxide red, casks	lb.	.10 – .16
Para toner, kegs	lb.	1.00 – 1.10
Vermilion, English, bbl	lb.	1.15 – 1.20
Yellow, Chrome, C.P. bbls	lb.	.17½ – .18
Ocher, French, casks	lb.	.02½ – .03

Waxes

Bayberry, bbl	lb.	$0.25 – $0.26
Beeswax, crude, Afr. bg	lb.	.21½ – .22
Beeswax, refined, light, bags	lb.	.32 – .34
Beeswax, pure white, cases	lb.	.40 – .41
Candellila, bags	lb.	.23 – .23½
Carnauba, No. 1, bags	lb.	.36 – .38
No. 2, North Country, bags	lb.	.21 – .21½
No. 3, North Country, bags	lb.	.18½ – .19
Japan, cases	lb.	.18 – .18½
Montan, crude, bags	lb.	.05¾ – .06
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.04½ – ....
Crude, scale 124-126 m.p. bags	lb.	.03½ – .03¾
Ref., 118-120 m.p., bags	lb.	.04 – ....
Ref., 125 m.p., bags	lb.	.05 – ....
Ref, 128-130 m.p., bags	lb.	.04½ – ....
Ref., 133-135 m.p., bags	lb.	.05 – .05¼
Ref., 135-137 m.p., bags	lb.	.05½ – ....
Stearic acid, sgle pressed, bags	lb.	.11½ – .11¾
Double pressed, bags	lb.	.12 – .12¼
Triple pressed, bags	lb.	.13 – .13½

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$8.00 – $8.25
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.90 – ....
Blood, dried, bulk	unit	4.10 – 4.15
Bone, raw, 3 and 50, ground	ton	26.00 – 28.00
Fish scrap, dom., dried, wks.	unit	..... – .....
Nitrate of soda, bags	100 lb.	2.45½ – ....
Tankage, high grade, f.o.b. Chicago	unit	3.25 – 3.35
Phosphate rock, f.o.b. mines		
Florida pebble, 68-72%	ton	4.00 – 4.50
Tennessee, 78-80%	ton	7.75 – 8.00
Potassium muriate, 80%, bags	ton	34.55 – ....
Potassium sulphate, bags basis 90%	ton	45.85 – ....
Double manure salt	ton	27.00 – ....
Kainit	ton	7.22 – ....

Crude Rubber

Para—Upriver fine	lb.	$0.22 – ....
Upriver coarse	lb.	.17¾ – ....
Upriver caucho ball	lb.	.19¾ – ....
Plantation—First latex crepe	lb.	.25¾ – ....
Ribbed smoked sheets	lb.	.25¾ – ....
Brown crepe, thin, clean	lb.	.23¾ – ....
Amber crepe No. 1	lb.	.24¾ – ....

Gums

Copal, Congo, amber, bags	lb.	$0.10 – $0.15
East Indian, bold, bags	lb.	.20 – .21
Manila, pale, bags	lb.	.19 – .20
Pontinak, No. 1 bags	lb.	.19 – .20
Damar, Batavia, cases	lb.	.25 – ....
Singapore, No. 1, cases	lb.	.32 – .33
Singapore, No. 2, cases	lb.	.21½ – .22
Kauri, No. 1, cases	lb	.64 – .66
Ordinary chips, cases	lb.	.20½ – .21½
Manjak, Barbados, bags	lb.	.09 – .14

Shellac

Shellac, orange fine, bags	lb.	$0.62 – .63
Orange superfine, bags	lb.	.64 – .65
A. C. garnet, bags	lb.	.61 – .62
Bleached, bonedry	lb.	.70 – .71
Bleached, fresh	lb.	.59 – ....
T. N., bags	lb.	.59 – .60

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b. Quebec	sh. ton	$325.00 – $450.0
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 – 70.0
Asbestos, cement, f.o.b., Quebec	sh. ton	17.00 – 20.0
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 – 17.0
Barytes, grd., off-color, f.o.b. Balt	net ton	13.00 – 14.0
Barytes, floated, f.o.b. St. Louis, bbl	net ton	23.00 – 24.0
Barytes, crude f.o.b. mines, bulk	net ton	8.50 – 10.0
Casein, bbl., tech	lb.	.11½ – .12
China clay (kaolin) crude, No. 1, f.o.b. Ga	net ton	8.50 – 10.0
Washed, f.o.b. Ga	net ton	8.00 – 9.0
Powd., f.o.b. Ga	net ton	13.00 – 20.0
Crude f.o.b. Va	net ton	6.00 – 8.0
Ground, f.o.b. Va	net ton	13.00 – 19.0
Imp., lump, bulk	net ton	15.00 – 20.0
Imp., powd	net ton	45.00 – 50.0
Feldspar, No. 1 f.o.b. N.C.	long ton	6.60 – 7.75
No. 2 f.o.b. N.C.	long ton	4.50 – 5.00
No. 1 soap	long ton	8.50 – ....
No. 1 Canadian, f.o.b. mill, powd	long ton	20.00 – ....
Graphite, Ceylon, lump, first quality, bbl	lb.	.05½ – .0
Ceylon, chip, bbl	lb.	.04½ – .05
High grade amorphous crude	ton	15.00 – 35.00
Gum arabic, amber, sorts, bags	lb.	.11½ – .12
Gum tragacanth, sorts, bags	lb.	.50 – .55
No. 1, bags	lb.	1.35 – 1.40
Kieselguhr, f.o.b. Cal	ton	40.00 – 42.00
F.o.b. N. Y	ton	50.00 – 55.00
Magnesite, crude, f.o.b. Cal	ton	14.00 – 15.00
Pumice stone, imp., casks	lb.	.03 – .05
Dom., lump, bbl	lb.	.05 – .0
Dom., ground, bbl	lb.	.05½ – .0
Silica, glass sand, f.o.b. Ind	ton	2.00 – 2.50
Silica, sand blast, f.o.b. Ind	ton	2.25 3.50
Silica, amorphous, 200-mesh, f.o.b. Ill	ton	20.00 – ....
Silica, glass sand, f.o.b. Ill	ton	1.75 – 3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 – 8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	8.00 – 8.50
Talc, 200 mesh, f.o.b. Ga., bags	ton	8.00 – 9.00
Talc, 350 mesh, f.o.b. New York, grade A bags	ton	22.00 – ....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.50 – $4.00
Corning	bbl.	1.80 – .....
Cabell	bbl.	1.75 – .....
Somerset	bbl.	1.65 – .....
Illinois	bbl.	1.72 – .....
Indiana	bbl.	1.73 – .....
Kansas and Okla. under 28deg.	bbl.	.75 – .....
California, 35 deg. and up	bbl.	1.01 – .....

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.17½ – .....
Naphtha, V. M. & P. deod, steel bbls	gal	.16½ – .....
Kerosene, ref. tank wagon	gal.	.15 – .....
Bulk, W.W. delivered, N.Y.	gal.	.09 – .....
Lubricating oils:		
Cylinder, Penn., dark	gal.	.26 – .....
Bloomless, 30@31 grav	gal.	.18 – .....
Paraffin, pale	gal.	.16 – .1
Spindle, 200, pale	gal.	.21 – .2
Petrolatum, amber, bbls	lb.	.03½ – .0
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140-14
Chrome brick, f.o.b. Eastern shipping points	ton	45–
Chrome cement, 40-50% Cr_2O_3	ton	23–2
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.0
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	42–4
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	35–
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–
9-in. arches, wedges and keys	ton	80–
Scraps and splits	ton	
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	50–
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	50–5
F.o.b. Mt. Union, Pa	1,000	42–
Silicon carbide refract. brick, 9-in.	1,000	1180.0

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 – .....

Frerochromium, per lb. of Cr, 1-2% C	lb.	$0.30	–
4-6% C	lb.	.10½	–
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	109.00	–
Spiegeleisen, 19-21% Mn	gr. ton	38.00	40.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00	2.50
Ferrosilicon, 10-12%	gr. ton	41.50	46.50
50%	gr. ton	75.00	–
Ferrotungsten, 70-80%, per lb. of W	lb.	.85	.90
Ferro-uranium, 35-50% of U per lb. of U	lb.	4.50	–
Ferrovanadium, 30-40% per lb. of V	lb.	3.50	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	$5.50	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00	23.00
C.i.f. Atlantic seaboard	ton	19.50	22.00
Coke, fdry., f.o.b. ovens	ton	5.00	5.50
Coke, furnace, f.o.b. ovens	ton	3.75	4.00
Fluorspar, gravel, f.o.b. mines' Illinois	ton	23.50	–
Ilmenite, 52% TiO_2	lb.	.00¾	.01
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.38	.42
Manganese ore, chemica (MnO_2)	ton	75.00	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80	–
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06	.08
Pyrites, Span., fines, c.i.f Atl. seaport	unit	.11½	.12
Pyrites, Span., furnace size c.i.f. Atl. seaport	unit	.11½	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12	–
Rutile, 95% TiO_2	lb.	.12	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.50	10.00
Tungsten, wolframite, 60% WO_3	unit	9.00	–
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25	2.50
Vanadium pentoxide, 99%	lb.	2.00	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00	1.25
Zircon	ton	50.00	–

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12½–$0.12¾
Aluminum, 98 to 99%	lb.	.27½– .28½
Antimony, wholesale, Chinese and Japanese	lb.	.10½– .10¾
Nickel, 99%	lb.	.26 – .30
Monel metal, shot and blocks	lb.	.32
Monel metal, ingots	lb.	.38
Monel metal, sheet bars	lb.	.45
Tin, 5-ton lots, Straits	lb.	.50½
Lead, New York, spot	lb.	.08
Lead, E. St. Louis, spot	lb.	.08
Zinc, spot, New York	lb.	.0680
Zinc, spot, E. St. Louis	lb.	.06458
Silver (commercial)	oz.	.62¾
Cadmium	lb.	.75@.80
Bismuth (500 lb. lots)	lb.	2.30
Cobalt	lb.	3.00-3.25
Magnesium, ingots, 99%	lb.	.90–.95
Platinum	oz.	122.00
Iridium	oz.	275.00–300.00
Palladium	oz.	83.00
Mercury	75 lb.	60.00
Tungsten	lb.	.90–.95

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.50
Copper bottoms	29.50
Copper rods	20 00
High brass wire	18.00
High brass rods	15.50
Low brass wire	20.00
Low brass rods	20.50
Brazed brass tubing	23.50
Brazed bronze tubing	25.00
Seamless copper tubing	23.50
Seamless high brass tubing	22.00

OLD METALS—The following are the dealers purchasing prices in cents per pound:

Copper, heavy and crucible	10.00 @ 10.25
Copper, heavy and wire	9.87½ @ 10.00
Copper, light and bottoms	8.00 @ 8.25
Lead, heavy	6.62½ @ 6.87½
Lead, tea	3.62½ @ 3.87½
Brass, heavy	5.25 @ 5.50
Brass, light	4.50 @ 4.75
No. 1 yellow brass turnings	5.00 @ 5.12½
Zinc scrap	3.75 @ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.54	$3.54
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

TROY—The Standard Chemical & Oil Co. has preliminary plans for extensions in its plant and will rebuild a structure recently destroyed by fire.

ENSLEY—The Birmingham Hollow Tile Co. is planning for the rebuilding of the portion of its plant at 24th St. and Ave. C, recently destroyed by fire with loss of about $37,000, including equipment.

Arkansas

FORT SMITH—The Arkansas Oil Refinery will have plans prepared soon for enlargements in its plant for considerable increase in output. S. M. Newton and R. Steinhors, both of Tulsa, Okla., head the company.

FORT SMITH—The Monol Window Glass Co. is perfecting plans for the early rebuilding of the portion of its plant recently destroyed by fire with loss estimated at about $200,000. Considerable additional equipment will be installed. C. P. Zenor heads the company.

BETHESDA—The Batesville White Lime Co., Ruddells, Ark., formerly known as the Arkansas Lime Co., has acquired a local tract of about 250 acres of land, fronting on the Missouri Pacific R.R., and plans for the construction of a new calcining and hydrating plant, with initial capacity of about 75 tons per day. Three large kilns will be installed and auxiliary equipment, including power house. The company purposes to maintain its present plant at Ruddells, to be devoted exclusively to chemical lime production. The capital has been increased from $100,000 to $300,000 to provide for the expansion.

California

SAN FRANCISCO—The Richmond Sanitary Mfg. Co., 460 2nd St., manufacturer of sanitary ware, has awarded a general contract to Cahill Brothers, Sharon Bldg., for the erection of a new 4-story and basement building at Brannan, Division and 10th Sts., estimated to cost $45,000.

LOS ANGELES—The Republic Brass Mfg. Co., 1931 Violet St., manufacturer of aluminum and brass castings, etc, has awarded a general contract to May & Grimwood, Haas Bldg., for the erection of a new 1- and 2-story plant on 27th St., near Santa Fe Ave., to cost in excess of $50,000, with equipment.

Connecticut

WINSTED—The Universal Bronze Bearing Co. has tentative plans under advisement for the rebuilding of the portion of its plant, destroyed by fire, Jan. 12, with loss approximating $32,000.

Florida

SANFORD—The Florida-McCracken Concrete Pipe Co., recently formed as a subsidiary of the McCracken Mfg. Co., Sioux City, Ia., with capital of $300,000, has purchased a local tract of land, comprising about 6 acres, as a site for a new plant for the manufacture of concrete pipe. The initial works will be equipped for an output of 2,500 ft. per day, and is estimated to cost approximately $75,000. W. J. McCracken is president; C. D. Watson, St. Petersburg. Fla., is plant superintendent.

Georgia

SILVER CREEK—The American Chemical Co. is reported to be perfecting plans for the erection of a new local plant for the production of tripoli for commercial service. It is estimated to cost approximately $90,000, with equipment. Joel Perkinson, Chattanooga, Tenn., will be in charge of construction.

COLUMBUS—The Home Mixture Guano Co. has tentative plans for the rebuilding of the portion of its local works, recently destroyed by fire with loss reported at $25,000.

Illinois

CHICAGO—John G. Carlson & Co., 1611 Sheffield Ave., manufacturers of paints, etc., have selected Anton A. Tocha, 1064 Milwaukee Ave., architect, to prepare preliminary plans for a new 4-story and basement plant, 50x85 ft., to cost approximately $75,000. No date has been decided as to when bids will be called.

CHICAGO—W. H. Freund & Co., care of Burrett Stephens, 37 West Van Buren St., architect, will soon take bids for the construction of a new plant at 110 North Market St., for the production of paper products, to be equipped primarily as a refinishing paper mill. It will be 1- and 2-story, estimated to cost about $60,000.

Kansas

HUMBOLDT—The Cement Securities Co., headed by C. Boettcher, Denver, Colo., has negotiations under way for the purchase of the local plant of the Monarch Cement Co. Upon acquisition, the new owner proposes to extend and improve the mill, with the installation of additional equipment for considerable increase in output.

Kentucky

LOUISVILLE—The Louisville Petroleum Refining Co. has work under way on a new local refining plant, to be equipped for an initial daily production of about 2,000 bbl., and will commence operations at the earliest date. The plant will cost in excess of $100,000. W. J. Caveney is construction engineer, in charge.

Louisiana

MONROE—The Chester Carbon Co., 315 Ouachita National Bank Bldg., is perfecting plans for the construction of two new carbon black plants on local sites, each two-unit type, to cost in excess of $100,000. Percy P. Learned is president.

BATON ROUGE—The Texas Chemical Co., Houston, Tex., has purchased a local tract of land on Baker Rd., totaling about 60 acres, and plans for the construction of a new plant, estimated to cost about $550,000. The works will be equipped primarily for the production of sulphuric acid, the output to be used by the Standard Oil Co., at its large local refinery. Erection will be commenced at an early date.

Minnesota

DULUTH—The Dominion Tar & Chemical Co. has plans for the construction of a new plant in the vicinity of 59th St., West, to cost about $100,000, including equipment. It is purposed to break ground early in the spring.

Missouri

KANSAS CITY—The Abner Hood Chemical Co. has purchased a building on Montgall Ave., and will remodel and equip the structure for a new plant. It is purposed to have machinery ready for service at an early date.

ST. LOUIS—The Day Rubber Co. has tentative plans for the rebuilding of the portion of its local plant, recently damaged by fire, with loss reported in excess of $100,000.

Nebraska

GERING—The Great Western Sugar Co. is reported to be planning for the early rebuilding of the portion of its local mill, recently destroyed by fire with loss of about $100,000, including machinery.

New Jersey

NEWARK—The Heller & Merz Co., Wilson Ave., manufacturer of colors, dyes, etc., has filed plans for the erection of a 1-story factory addition.

NEWARK—Mitchell & Smith, Inc., 39 Barbara St., manufacturer of cork products, plans for the rebuilding of the portion of its works destroyed by fire, Jan. 16, with loss estimated at $12,000.

PERTH AMBOY—The National Fireproofing Co., Fulton Bldg., Pittsburgh, Pa., has commissioned Sidney F. Heckert, Bessemer Bldg., Pittsburgh, architect and engineer, to prepare plans for the construction of a new local plant on site of its former works,

destroyed by fire several months ago, with loss of about $200,000. The new plant is estimated to cost approximately a like amount.

ELIZABETH — Fire at the plant of the Standard Oil Co., Jan. 10, known as the Bayway Refinery, caused a damage of about $40,000, including equipment. It is planned to rebuild.

New York

DEFERIET — The St. Regis Paper Co., Watertown, N. Y., has plans nearing completion for the construction of five new units at its local mill, to be 1- and 2-story, estimated to cost $500,000, including equipment. The company has also selected a tract of property at St. Augustin, near Quebec, as a site for a new mill, to consist of a number of pulp and paper units, with estimated cost placed at $3,500,000. Plans will be drawn in the near future.

LONG ISLAND CITY — The United States Book Match Corp., 141 Hinsdale Ave., Brooklyn, has leased a building on Marion St., Long Island City, totaling about 15,000 sq.ft., and will remodel and improve for a new plant. It is planned to install equipment and occupy at an early date.

North Carolina

NEWTON—The Fibre Mfg. Co., recently organized by Julius W. Abernethy and S. J. Smyer, has acquired the local mill of the Newton Asbestos Co. The new owner will take immediate possession, and plans for extensions and improvements. It is purposed to develop maximum output in the near future.

Ohio

ASHTABULA—The Ashtabula Steel Sheet Co. has plans in progress for enlargements in its mill to provide for an increase of about 500 tons per month. A new hot roll and other departments will be installed.

Oklahoma

PONCA CITY—The Empire Refining Co. has tentative plans under advisement for the construction of a new oil refinery in this section, with reported cost in excess of $200,000.

Pennsylvania

LATROBE—The Anchor Drawn Steel Co., Farmers' Bank Bldg., Pittsburgh, Pa., has purchased a local site for a new plant for the production of high-speed and carbon steel products, and cold-drawn specialties. Plans will be prepared for the initial unit, 80x290 ft., with L extension, 50x120 ft., to cost in excess of $100,000, including equipment. D. R. Wilson, formerly vice-president of the Carbon Steel Co., heads the organization.

TRAINER—The Sinclair Old Co., 45 Nassau St., New York, will resume active work on the erection of its new local refining plant, on which operations have been curtailed for a number of weeks. It is proposed to have the structure ready for machinery at an early date. It will cost approximately $2,000,000, including equipment.

HARRISBURG — The Air Reduction Sales Co., 342 Madison Ave., New York, is reported to have selected a local site for a new plant for the manufacture of industrial oxygen, acetylene gas and kindred products, estimated to cost close to $250,000, including equipment. It is said that plans will be drawn at an early date.

LEWISTOWN — The Pennsylvania Wire Glass Co., Pennsylvania Bldg., Philadelphia, has plans maturing for its proposed local plant, and purposes to take bids on a general contract in February. The initial unit will be 1-story, 180x750 ft., with power house and other miscellaneous buildings, estimated to cost about $450,000, including equipment. Frank W. Hayes is company architect. Walter Cox is president.

Tennessee

CHATTANOOGA — The Crane Enamelware Co., manufacturer of sanitary enameled iron products, a subsidiary of the Crane Co., 836 South Michigan Ave., Chicago, Ill., has plans in progress for the erection of an addition to its plant in the Alton Park section, to be 1-story, 40x100 ft., equipped primarily for grinding service. It is proposed to double the output of this department.

NASHVILLE—The Tennessee Enamel Mfg. Co., Park Ave., has authorized plans for the erection of a new 1-story plant, 95x 185 ft., to replace the portion of its works recently destroyed by fire. The company specializes in the manufacture of porcelain enamel specialties, and will install enameling equipment, furnaces, air compressors, presses and other machinery, for which a list will soon be prepared. M. H. Wright is president.

Texas

SWEETWATER — The Sweetwater Cotton Oil Co. has preliminary plans for the rebuilding of the portion of its plant recently destroyed by fire with loss estimated at $40,000, including equipment. The new structure is estimated to cost a like amount.

PORT ARTHUR—Fire, Jan. 15, destroyed a portion of the local oil refinery of the Texas Co., with loss reported in excess of $500,000, including equipment. It is planned to rebuild.

BECKENRIDGE—The National Gasoline Co. has authorized plans for the rebuilding of the portion of its local mill, recently destroyed by fire with loss estimated at $50,000, including equipment. Thomas Patton is manager.

SOUR LAKE—The Southwestern Refining Co. has plans under consideration for extensions and improvements in its local plant, including the installation of additional equipment. C. J. Laughren is president, and W. L. Hunter secretary.

Vermont

WELLS RIVER—The Adams Paper Co. has work in progress on extensions and improvement in its plant for the production of kraft and manila tissue papers, estimated to cost $75,000, including equipment.

Virginia

BEDFORD—The Board of Trade is interested in a project to construct and operate a local plant for the manufacture of automobile tires and other rubber products, estimated to cost close to $90,000, including equipment. It is expected to organize a company to run the plant.

West Virginia

FAIRMONT — J. Clyde Morris, director, bureau of water, will receive bids until Feb. 11 for the installation of a mechanical filtration plant at the municipal waterworks, with rated daily capacity of 4,000,000 gal. Fuller & McClintock, 170 Broadway, New York, are engineers.

CHARLESTON — The Virginia Rubber Co. has authorized plans for the rebuilding of the portion of its plant in the Highlawn section, destroyed by fire, Jan. 12, with loss estimated at $400,000, including machinery.

New Companies

VAPORINE CHEMICAL Co., Memphis, Tenn.; chemicals and chemical byproducts; $50,000. Incorporators: J. F. Barlow and J. R. Murray, both of Memphis.

PACIFIC GYPSUM TILE Co., Los Angeles, Calif.; gypsum tile, blocks and kindred products; $100,000. Incorporators: J. G. Johnston, Glendale, Calif.; F. R. and H. C. Kellogg, Los Angeles. Representative: Allen Frankel, 407 I. N. Van Nuys Bldg., Los Angeles.

COTOL CORP., Boonton, N. J.; chemicals and chemical byproducts; 200 shares of stock, no par value. Incorporators: F. T. White, Edward T. Kelly and Fritz V. Briesen. Representative: Edward T. Kelly, 331 Church St., Boonton.

STANDARD PYROXOLOID CORP., Leominster, Mass.; composition products; $300,000. John Philip Legere, president; and William H. Lane, Leominster, treasurer and representative.

SPECIAL CHEMICAL PRODUCTS, INC., New York, N. Y.; chemical compounds, etc.; 25 shares of stock, no par value. Incorporators: O. R. Tree, A. Stern and H. L. Beckett. Representative: W. G. Brown, Woolworth Bldg., New York.

OLMSTEAD PAPER Co., Danbury, Conn.; paper products; $25,000. Incorporators: Seymour L. Durgey and Frederick S. Olmstead, 66 North St., Danbury.

PULASKI MIRROR Co., Pulaski, Va.; glass products; $50,000. Incorporators: H. C. Gilner and Buelah Dillon, both of Pulaski, to act as president and secretary, respectively.

PUGET SOUND LIME & OIL Co., Seattle, Wash.; refined oils, lime products, etc.; $400,000. Incorporators: Charles W. Littlefield, Daniel C. Brownell and Philip T. Molleur, all of Seattle.

ATLANTIC COAST MFG. Co., INC., 931 Atlantic Ave., Atlantic City, N. J.; chemicals and chemical byproducts; $50,000. Incorporators: Morris L. and Joseph Goldberg, and William O'Connor.

SUNLIGHT CHEMICAL CORP., East Providence, R. I.; chemicals and chemical byproducts; 600 shares of stock, no par value. Incorporators: Leon W. Brower and E. Butler Moulton, Cranston, R. I.; and George E. Wilson, East Providence.

MCAVOY MFG. Co., INC., Detroit, Mich.; paints, varnishes, stains, etc.; $200,000. Incorporators: Garret C. Landon, Robert C. Oliver and Delmar McAvoy, 803 East Grand Blvd., Detroit.

WHITEX INC., New York, N. Y.; chemicals and chemical byproducts; 500 shares of stock, no par value. Incorporators: C. E. Seller and L. E. Scofield. Representative: C. J. Cadwalader, 1405 Canadian Bldg., New York.

SEABOARD PETROLEUM CORP., Los Angeles, Calif.; refined oil products; $5,000,000. Incorporators: J. M. Feldman, W. J. Batchelder and H. L. Burleson. Representative: Black, Hammack & Black, 419 American Bank Bldg., Los Angeles.

STRONG CHEMICAL Co., Kansas City, Mo.; chemicals and kindred products; $25,000. Incorporators: V. A. and Benjamin V. Strong, all of Kansas City.

REDSKIN PRODUCTS Co., Houston, Tex.; enamels for metal service; $15,000. Incorporators: W. H. Crawford, J. T. Wyse and M. E. Glenn, all of Houston.

IRVINGTON SOAP MFG. Co., INC., Irvington, N. J.; soaps, washing powders, etc.; $50,000. Incorporators: Bernard and S. G. Freedman, and Lovett A. Grant, 376 Coit St., Irvington. The last noted is representative.

CAMBRIDGE RUBBER Co., Cambridge, Mass.; rubber products; $500,000. Warren MacPherson, 748 Main St., Cambridge, is president and treasurer.

PRUDENTIAL CHEMICAL Co., 532 North Calvert St., Baltimore, Md.; chemicals and chemical byproducts; 200 shares of stock, no par value. Incorporators: Milton D. Swartz, Albert H. Samuel and Lee B. Rever.

UNITED STATES GUTTA PERCHA PAINT Co., Providence, R. I.; paints and kindred products; $150,000. Incorporators: Herbert W. and Wayland W. Rice, and Charles W. Eastwood, all of Providence.

FLORENCE SEED & FERTILIZER Co., Florence, S. C.; fertilizer products; $10,000. D. C. Shelly is president, and L. S. Shelly vice-president, both of Florence.

MICHAEL HAYMAN & Co., INC., Buffalo, N. Y.; metal smelting and refining; $1,200,000. Incorporators: Oscar M. and Edgar M. Hayman, 62 Colonial Circle, Buffalo.

ELECTRIC STEEL CASTINGS Co., Montague, Mass.; steel castings, $25,000. Olaf Hoff, Jr., 10 Maple Street, Turners Falls, Mass., is president, treasurer and representative.

Industrial Notes

THE DORR Co., engineers, sanitary engineering department, established a branch in Chicago, Jan. 1. Frank Bachman, heretofore a member of the New York staff, will have charge and will be located at the present office of the company, 38 South Dearborn St.

THE CLEVELAND-CLIFFS IRON Co. announces the removal of its offices from the Kirby Bldg. to the fourteenth floor of the Union Trust Bldg., Cleveland, Ohio.

THE DORR Co., New York, has closed its Joplin, Mo., office. All future work of this office will be carried on by the Denver office.

THE AMERICAN MANGANESE STEEL Co., Chicago Heights, Ill., announces the purchase of the foundry formerly operated by the Queen City Foundry Co. of Denver, Colo. Plans are being made to increase the capacity and modernize all equipment so that the foundry cannot only continue the usual line of work but in addition produce manganese steel castings under the Amsco patents and processes. The personnel of the Denver management will comprise men of many years experience with the manifold problems of production, field service and business routine. J. M. Blake, metallurgist, has been appointed general manager, and will be assisted by Kenneth Jensen as manager of sales. Mr. Jensen has represented the company for several years as traveling sales engineer. Mr. Blake in particular will be remembered by many customers in the intermountain states by reason of the numerous experiments and tests successfully conducted by him with various alloy steels. In addition, the company will be represented in Utah and eastern Nevada by Landes & Co. of Salt Lake City, Utah; in New Mexico and Arizona by Herbert B. Wolcott, Jr., of El Paso, Tex., and by the A. T. Herr Supply Co. of Denver in the State of Colorado.